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Motive Power of the Mile End Spool Cotton Mill.

The engraving upon this page represents a pair of high pressure condensing engines of the Corliss type, built by Watts, Campbell & Company, at the Passaic Iron Works, Newark, N. J. They were designed to form a part of the plant of the new mill of the Clark Mile End Spool Cotton Company at East Newark, N. J.

The cylinders are 32″ in diameter with 60″ stroke. These cylinders are made of a special mixture of best machinery scrap and new iron. This scrap and new iron is put into the cupola, where it is melted and run into pigs. When required it is melted a second time and cast into cylinders, and forms an exceedingly close-grained and durable material. These castings, as they come from the sand, present a very fine appearance, the surfaces being remarkably smooth.

They have been pronounced by foreign visitors to be superior to anything in the shape of castings produced in their countries and are certainly of the best done in this country. The exhaust ports open into a separate chamber, which although forming a part of the cylinder casting, is attached thereto by a web, so that the exhaust steam does not come in direct contact with the walls of the cylinder to reduce their temperature, thereby increasing cylinder condensation.

The entire casting is homogeneous in its structure, and free from blow-holes and other defects, which are liable to occur in ordinary foundry practice. The bed-plate is cast in a horizontal position, with the open side upwards, which brings both guides upon a level with each other. This method of casting prevents the formation of sand-holes and cold shot and shrinkage depressions upon the faces of the guides. A rigid support is placed under the ends of the guides, for the purpose of insuring extra strength, and to avoid springing of the bed. The pillow block is extra heavy, and is strengthened by ribs, and is strongly bolted to the bed. Should accident occur to any of these parts, they can be quickly replaced. The castings all through, like the cylinder castings, are of an exceptionally fine quality, and deserve special mention for their symmetry and smoothness. It has clearly been the aim of the builders of these engines, in designing, to err in the direction of strength and excess of wearing surface, rather than otherwise.

The fly-wheel is of greater weight than is generally allowed for automatic cut-off engines, for the reason that, in a spool cotton mill, a uniform speed is indispensable, and a slight increase in the speed of the engine may be attended with disastrous results to the machinery and product. This fly-wheel is 26 feet in diameter, with a face of 9′ 6″ wide.

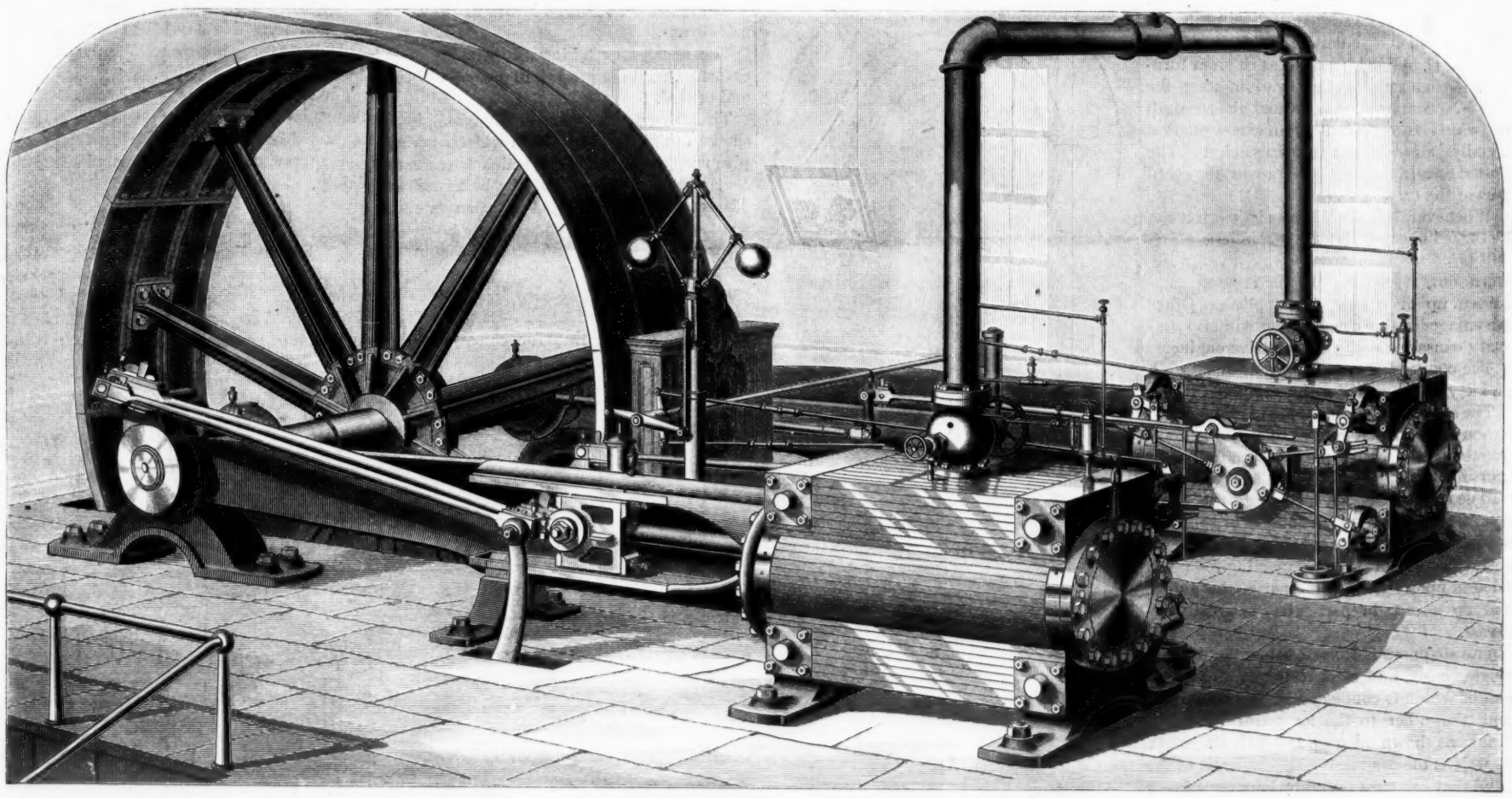
There are four belts instead of three (as shown in the engraving) upon the band fly-wheel of this engine. Their various widths are as follows: 36″, 26″, 24″ and 18″. The wheel is built up of ten segments, each segment having a spoke or arm bolted to it, as shown.

The hub is in two parts, which are tightly pressed upon the shaft by hydraulic pressure, and are then keyed.

Each segment is held to the hub by two bolts through each arm. Before drilling and reaming these holes, the wheel is made, by measuring the inside diameter of the rim from the center of the hub, to approximate as nearly as possible to a true circle. In this manner, when the wheel is turned, the inequalities are taken off the outside. Thus the rim is reduced to nearly a uniform thickness upon all sides, which makes the wheel run quite smoothly without perceptible vibration. The weight of this fly-wheel in the rough was 112,935 pounds. In finishing, it lost about ten per cent., which leaves a wheel possessing sufficient energy, when in motion at 60 revolutions per minute, to resist both the tendency toward the accelerated motion, due to the high initial pressure of 70 pounds at the commencement of the stroke, and the inclination toward retardation of the latter part of the stroke, resulting from the rapid decrease of pressure after the steam is cut off. The crank shaft is made of the best hammered iron, and is 16″ in diameter at the journals and $18\frac{3}{4}$″ diameter in the middle. Its weight is 16,500 pounds. The cut-off mechanism is of the Corliss design, but has been improved in details of construction.

This type of valve gear is too well known to require special description. One of the principal improvements is the dash pot, shown in detail upon page 2, in the accompanying engravings. Fig. 1 represents an outside view, Fig. 2 a vertical section through the center, and Fig. 3 a plan of the same. The outside shell or cylinder, *A*, *G*, is neatly bored, and the annular piston, *J*, *D*, *D*, fitted to it. A leather washer, *E*, *E*, is secured to the face of the annular piston, to prevent the iron surfaces from coming together; also to prevent any damage that might otherwise happen to the dash pot in consequence of the absence of some fibrous material, to act as a sort of fender.

The upper end of the rod *C*, secured to the piston by the pin *K*, connects with one arm of a bell crank upon the end of the valve stem; consequently each time the valve opens, the piston, *D*, *D*, rises, forming a vacuum above *B* in the upper or central chamber. The purpose of the vacuum, as is well known, is to assist in quickly closing the steam valve in cutting off, as soon as the opening mechanism is unhooked. When the valve closes, the cushioning necessary to arrest the parts without shock is accomplished in the lower or outer chamber, *E*, *E*. A small air cock screwed into the chamber *H* at *F*, communicating with the cylinder, *E*, *E*, enables the engineer to secure and maintain any degree of vacuum in the chamber, necessary to cushion the valve upon its return. By means of bolts through the flange *I*, this dash-pot is bolted to the end of the casting that supports the cylinder. The simplicity of its construction commends itself to the thoughtful engineer, and convinces him at once that little or no trouble is to be apprehended from



ENGINES OF THE MILE END THREAD MILL.

that source, but a perfect control of the steam valves in closing may be secured at all times.

The crossheads are made of cast iron, and of the style shown in the detail engravings of the same. *H* represents the crosshead, and *G* the piston-rod. It will be observed that the former is firmly secured to the latter by a tapered fit, with a steel key crosswise in the same manner as those used upon locomotives. In this manner when the work has been well executed at first, a perfect alignment between the crosshead and piston-rod can be maintained.

The gibs, *B, B,* are adjusted by tapered wedges, *E, E,* and are securely held in any desired position by the set screws and jam nuts, *F, F.* The faces *N* of the crosshead to receive the wedges, *L, M,* are accurately planed, and the wedges carefully fitted thereto. The nut *S* is fitted loosely to the hole through the wedge, the body *U* of the set screw bearing in the end of the gib. After minutely adjusting the gib by turning the head *T,* of the screw, the jam nut *R* is tightened, which permanently locks the gibs in position.

It will be seen that the crosshead is given additional strength by spreading the jaws *O, O,* and using additional metal. By this construction a wider bearing *I,* is obtained for the crosshead end of the connecting rod. This bearing is formed by a steel pin *J,* accurately fitted through the crosshead. Upon this pin shown enlarged at *P,* is a steel thimble *Q,* splined to prevent it from turning. When put together by tightening the nut *K,* a construction is formed, the strength of which is considerably in excess of that usually allowed for contingencies. The dotted lines in the view *A,* represent the cored part of the crosshead.

Whenever the thimble becomes worn it can be turned one-quarter of a revolution, which will bring the wear upon new parts, or when worn out, it can readily be removed and turned up or a new one applied. Other advantages of this construction will also suggest themselves to the appreciative engineer.

The connecting rods are provided with gib and key adjustment for the brasses.

The standard length adopted is six cranks; although somewhat greater than the general practice, this length possesses certain well-known advantages, which are believed to be sufficient to warrant incurring the extra cost, which is seen to be small when the resulting advantages are considered.

By the use of long connecting-rods the friction upon the working parts (the guides and crosshead, in particular) is greatly reduced.

The air-pump is located below the floor, is single acting, and is operated by a rod, one end of which is connected to the crank-pin, and the other to the long arm of a bell crank, as shown on page 1. This air-pump, as well as the condensing apparatus, is of the kind that has been found by long experience to be most simple and durable in construction, as well as reliable and efficient in operation.

The connecting-rod, eccentric-rod and hook are of the best hammered iron, while the crank-pin, piston-rod and parts are of steel. The various interchangeable pieces composing these engines are fitted up by the aid of special tools and machinery, but all parts can be made and repaired with such tools and appliances as are found in ordinary machine shops. It has been found by long experience that the cost of good work over poor is of trifling importance when the utility of the former is compared with that of the latter. This engine will develop, under ordinary conditions, about 1,500 horse-power, but is capable of working up to a much higher figure. Its total weight complete is 130 tons. The finish is plain and neat, and the cylinders are covered with lagging of black walnut, with brass bands. The throttle-valves are of a special, heavy pattern, and are made expressly for these engines by the manufacturers. Wherever lost motion is likely to occur, suitable means have been provided for taking it up. The boilers and boiler-house shown on page 3 are from designs furnished by the Babcock & Wilcox Co., 30 Cortlandt street, New York.

This boiler plant, when complete, will be composed of two sets or divisions, of 1,248-horse power each. The right-hand division remains vacant for the present, the one at the left being all that will be necessary for some time to come. The entire plant will consist of six independent batteries of boilers. Each battery is composed of two independent boilers, of 208-horse power each. Their general design is that of the well-known Babcox & Wilcox boiler, with some improved details. Each of these boilers is composed of twelve sections, or slabs, and each section is made up of nine best lap-welded wrought iron tubes, 4″ in diameter and 18 feet long.

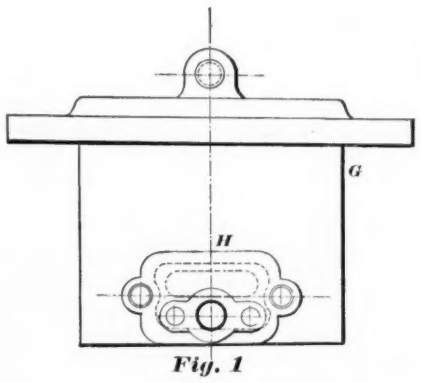


Fig. 1

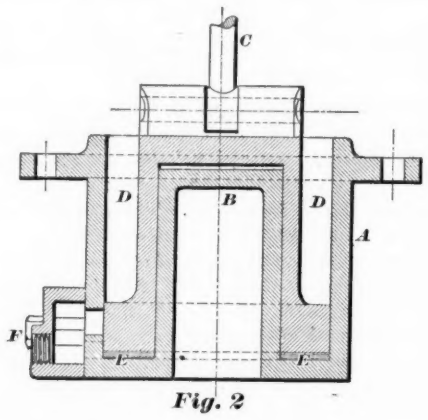


Fig. 2

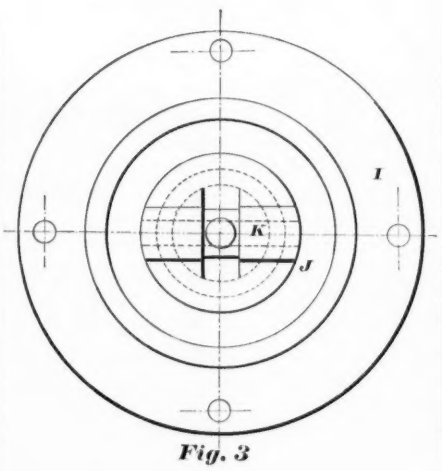


Fig. 3

These tubes are connected at the ends by continuous staggered headers, or "up takes" and "down takes," and the tubes fastened therein by being expanded into tapered holes.

To facilitate cleaning, a hand-hole is placed in the headers opposite the end of each tube. These hand-holes are of sufficient size to permit the removal and replacing of a tube through them, without disturbing any of the other tubes.

The method of covering these hand-holes is by a cap having a wrought iron bolt, nut and clamp for each. The joints are made tight, without packing, by grinding. At each end the sections are connected with two wrought iron drums, containing steam and water. These drums are 36″ in diameter and 18 feet long. They are made of flange iron, $\frac{5}{16}$″ thick, in three sheets, the longitudinal seams being double riveted.

The heads are turned in a lathe, and the rivet holes drilled.

A man-hole is located in the rear head of each drum.

The nozzles for taking off steam are 5″ in diameter, with flanges 11″ in diameter, faced and drilled.

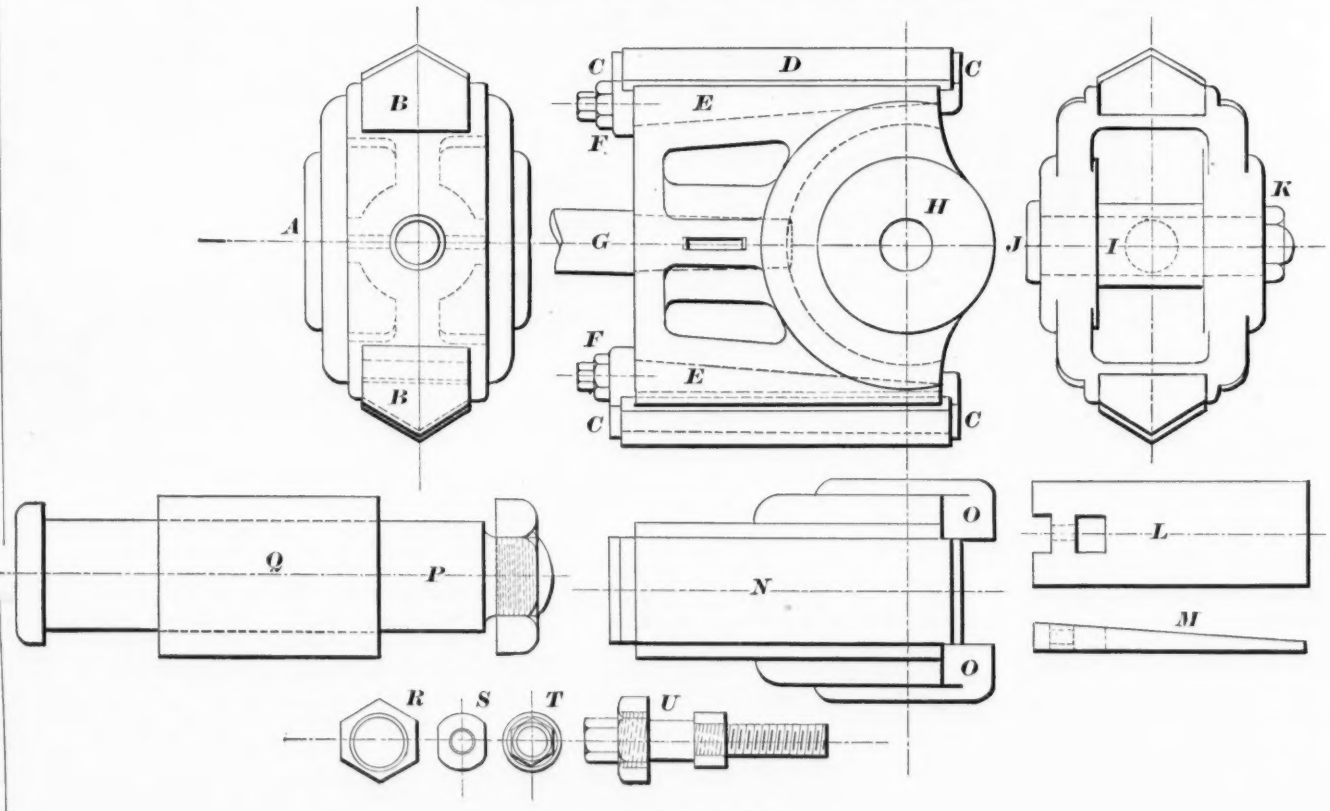
These drums are connected by cross-pipes, shown in the plan view, from which a spring pipe runs to the 15″ main, which latter runs nearly the entire length of the boiler-house. The sections are connected at their rear ends to a mud drum, which runs nearly across the furnace. The mud drums are of cast iron, 18″ in diameter and 8′ 8″ long, with three hand-holes. There are also two nozzles in each drum, for attaching blow-off pipes, 2½″ in diameter. The flue for conveying the products of combustion from the boilers to the chimney is double, as shown at the rear end of the boiler-house. In other words, the gases can either be thrown into a direct flue underneath the economizer to the chimney, or can be passed up through the 8-foot by 5-foot damper, shown at one end, thence across the economizer, then into the stack.

Experience has demonstrated that it is best to divide the economizer into two parts, as it makes the flues more direct, and allows one to be in use while the other is being cleaned or repaired, as may occur in emergency. Furthermore, this arrangement makes a more symmetrical plant.

The ground level shown in the cross-sections of the boiler-house is the street level, and the seven-foot door in front of the boilers is for dumping the coal from the street directly into the boiler-room. The diagonal wall shown in the plan across the circular flue at the base of the chimney is put in that position for the purpose of giving a larger and an easier line from the horizontal to the vertical flue. It is also intended to prevent two currents of gases from interfering with each other until they begin to travel in the same direction. Each battery of these boilers is suspended from two wrought-iron compound beams resting upon six wrought-iron columns, with cast-iron bases and caps so fastened that the boilers are supported entirely independent of the brick-work. Thus the boiler is free to expand and contract without damaging the brick-work, and, when necessary, the latter can be entirely removed and replaced without disturbing in the least either the boilers or their connections. Each boiler is furnished with two 4″ pop safety valves, set to blow off at 90 pounds pressure per square inch. Besides this, they have steam gauges, stand pipes, glass water-gauges and gauge cocks, and are provided with suitable means for cleaning the same. The boiler fronts are of the ornamental design, used upon most of the work erected by the builders of these boilers.

They each have four fire doors, with registers and four double ash-pit doors; also, large doors for gaining access to the ends of the tubes and for cleaning.

The setting is also provided with the requisite number of smaller doors for inspecting and cleaning the rear of boilers and flues. The engravings represent this plant quite plainly.



DETAILS OF CROSS HEAD.

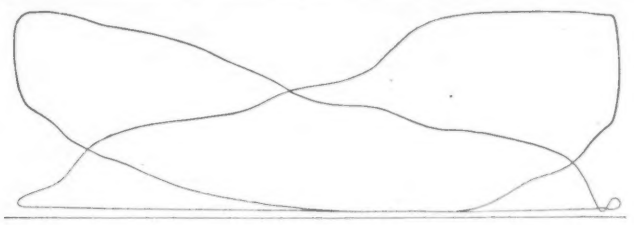
High Speed Indicating.

Absolute freedom of the moving parts of the indicator, while always of the first importance, is more noticeably so in the case of high-speed engines. A slight "hitch" in the piston or pencil movement at 100 revolutions may influence the line of the diagram for a short distance only, while an inaccuracy during the same time at four or five hundred revolutions may cover a considerable part of it. Much of the difficulty of high-speed indication is due to not having the indicator in proper condition for use, and many of the complaints about indicators are from the same cause. The lack of freedom in the piston or pencil movement may be at once apparent in the form of the diagram, or it may destroy its accuracy, and hence its use-

fulness, without the fact being apparent except after careful analysis—perhaps not then.

The connection with the paper drum, at high speeds, is of equal importance with the perfection of the pencil movement, as imperfection in either introduces inaccuracies about equal; in fact, it is sometimes a matter of some little difficulty to locate the trouble as between the pencil and drum movement. This connection should be as short, direct and rigid as possible, and the spring of the paper drum should be adjusted to strong tension, so that the strain on the cord will be practically constant; then, by using a piston spring strong for the pressure—say, a 60 spring for 80 lbs.—and correspondingly shortening the length of the diagram, good results may be obtained at speeds frequently considered impracticable.

As showing what may be accomplished by careful attention to these details, the pair



grams enclose sufficient space for calculations, and may be safely taken as an example of good practice at unusual speed. We do not know the build of engine from which they were taken, nor other particulars further than given.

Prospects of the Chicago Railway Exposition.

The National Exposition of Railway Appliances to be held in Chicago from May 25th to June 23d, is awakening considerable interest in mechanical circles. The display of iron and wood working machinery will be large and varied. Many entries for large space have already been made by such houses as J. A. Fay & Co., Wm. Sellers & Co., Niles Tool Works, and others well and favorably known.

In locomotives probably the best exhibition ever made in this country will be afforded. The Baldwin Locomotive Works are to send five locomotives to be admired and criticised; the Brooks Locomotive Works seven, and the Hinckley Works, and other builders, such styles and sizes of engines as they deem proper to represent the character of their production. "The Old Curiosity Shop" is a department where a collection of the earliest railway appliances will be shown; also odd and attractive articles from every department of railway service. Here can be seen George Stephenson's Rocket, the first locomotive ever built and worked successfully. It will be sent to the Exposition from the South Kensington Museum in London.

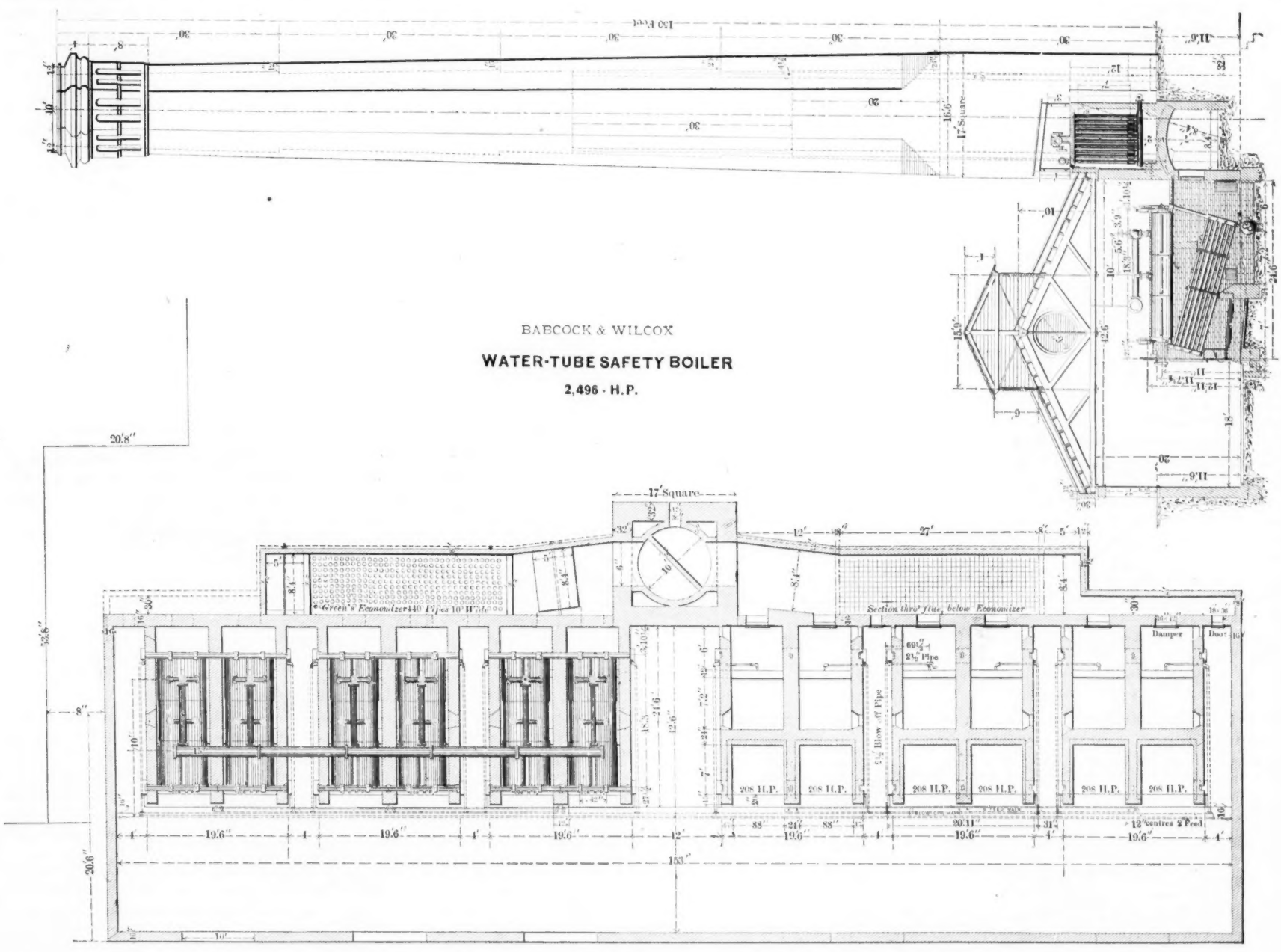
The rush for space has been so great that the managers have decided to build an annex of extensive proportions so as to quadruple the present available space. It will include a large addition to the portion devoted to machinery requiring power. It is stated that there are now nearly enough entries of locomotives and cars of all descriptions to fill the space to be devoted to such now provided for, and a considerable addition will be needed. Those who visited the Cotton Exposition at Atlanta will appreciate the character of the display to be made by the Southern railroads, consisting of samples of plants, minerals, woods and other productions along their lines. Some of the Northwestern railroads will also exhibit collections of live fish in tanks as samples of what sportsmen may catch along their lines.

Foundrymen sometimes complain, probably with a good deal of justice, that there is more of the fixed-price principle, without reference to circumstances, in their business than in that of most other mechanics. As, for instance, a customer will take a pattern to a foundry late in the day, and expect to get his casting the same day and at the regular price, notwithstanding to do it other work must be stopped, at a loss, perhaps, greater than he will pay for his casting. Another frequent complaint is, that in ordinary foundry work customers are not willing to pay for any improvement, no matter how much may be saved in machine work and otherwise.

A well-known foundryman relates an instance in which a party, not a regular customer, brought a pattern to the foundry about nine o'clock in the morning to get a casting the same day. A different plan than the one employed in the foundry where the piece was usually made was adopted for making it, with which the customer was not entirely satisfied, and he was given a price one cent per pound higher than the regular price, which was still less satisfactory. However, the piece was made, and a few days afterwards the customer informed the superintendent that after adding the work required on the casting in the machine shop, he found that, notwithstanding he paid one cent per pound more for the casting, the finished piece had cost $5.75 less than usual.

An effectual method of breaking up considerable pieces of iron and steel has come into use as a substitute for the process of melting them by means of colossal air furnaces—namely, the application of the force which confined water exerts in every direction upon the material in which it is enclosed.

A round hole, two or three inches in diameter and ten or twelve inches deep, is bored into the mass to be split, the hole being then filled with water and closed by a tight-fitting steel cylinder, upon which the weight is allowed to fall from the usual height. In this way a plate roll of some thirty inches diameter has been split into four or five parts, the pieces flying twenty or thirty feet. A single blow of an ordinary drop weight usually suffices to split off pieces of thirty to thirty-six inches in diameter. It being essential that the hole be hermetically closed, this is accomplished by hollowing out the base of the steel cylinder into a cup-shaped form, the edges of which are driven against the walls of the hole by the water in its endeavor to get past. A pin of good steel can be used several times in this operation.—*St. Louis Republican.*



of diagrams shown are reproduced from the original, handed us by an engineer. The memoranda on these diagrams shows that they were taken with a "Tabor" indicator at a speed of 510 revolutions per minute, and with a 64 spring. The "graceful undulations," particularly of the right-hand diagram upon which the cut-off is represented as somewhat sharper than that shown by the left-hand diagram, demonstrate conclusively that the indicator was in the best possible condition, in direct opposition to that which is shown by a series of steps, or (at this speed) by a smooth line.

The diagrams indicate amplitude of exhaust opening, the time between this opening and the completion of the stroke being insufficient to allow the pencil to entirely recover from the shock of the almost instantaneous fall of pressure. We are not entirely certain as to the location of the atmospheric line, since, while all the lines of the diagrams proper were distinct, though evidently taken with a light touch of the pencil, this line was not fairly discernible. These dia-

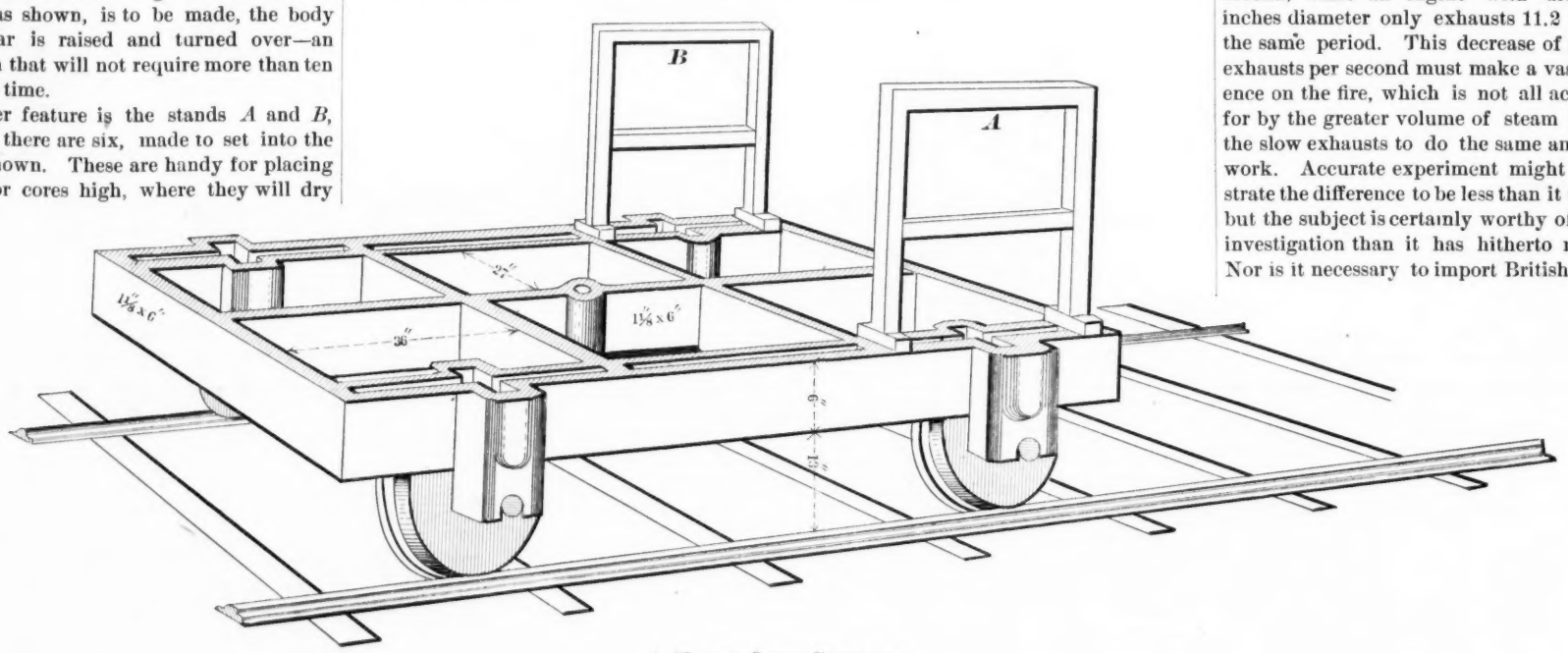
A Handy Oven Carriage.

By Thomas D. West.

One of the most essential conveniences of a jobbing foundry is a convenient oven carriage—quite as essential as it is to have a good crane or cupola. Oven carriages are usually made in sections and bolted together. This is an easy way to make them, but it does not make a good car when done, for the reason that it will spring and warp out of shape when moved along the track, cracking and breaking the brick-work of the mould.

The car shown in the cut is one that I constructed, and, as I have found it very convenient and reliable, I thought it worth a description. It will be noticed that the construction is such that the car can be turned over on the wheels, the axles having their bearings, as indicated by dotted lines. When thus turned over, the body of the car comes within about one inch of the track. The object of this is, that for ordinary work the carriage can be used as shown, which makes it convenient to get under to finish the bottom of a loam mould. This is safer than working under a mould suspended from a crane; besides, it leaves the crane at liberty for other purposes. When an exceptionally high mould that will not go into the oven on the car, as shown, is to be made, the body of the car is raised and turned over—an operation that will not require more than ten minutes' time.

Another feature is the stands *A* and *B*, of which there are six, made to set into the car, as shown. These are handy for placing moulds or cores high, where they will dry quicker, or for placing a number of cores or moulds on the carriage. When the stands are not needed, they can be taken out and set out of the way.



A Handy Oven Carriage.

Another feature of this car is the spindle seat in the center. The same chill should be used for casting this that is used for the green sand spindle seat, so that the pattern-maker will not be confused when making sweeps. The advantage to a loam moulder of this spindle seat will need no explanation. In a shop where room is not abundant it will pay for itself in a short time.

In moulding the body of this car, a full pattern is not required. One side, or the double section with the wheel-bearings and the ends and center crossbar pieces, is all that is required. The distance apart of the two pieces of the double section was in this instance 5".

When one side is rammed up, draw the pattern and ram up the other side. It will cast open if the iron is hot enough to fill up level.

The axle-bearings are easily oiled, and the construction saves work in fitting up. To cast these bearings use four chills. The ease with which the car will run on the bearings cast on the chills will soon pay for them.

In laying the track for this car, the sleepers should not be more than 30" apart, and should be well bedded. Long rails should be used, as they give a much better support than short ones. Before filling with sand between the sleepers, it is well to load the car heavily and pass it three or four times over the rails. This will develop the weak spots, which can be leveled and tamped up.

A piece of angle iron should be bolted to each end of one of the rails. This may seem a small matter, but the back end of many oven-walls shows the effect of neglecting small things.

In New York City 103 fires in 1880 were the result of using kerosene oil below the standard test.

Messrs. Hick, Hargreaves & Co., of Bolton Soho Iron Works, are at present completing engines of enormous proportions for an immense cotton mill in Bombay. They are for one of the Manockjee Petit Mills, owned by Mr. Durshaw, a wealthy Parsee. The largest mill engines used in this neighborhood are of about 1,000-horse power, whilst these are of 4,000-horse power, with cylinders of 50 in. and 84 in. diameter, and 8 ft. stroke, with steam 100 lbs. pressure, and 720 ft. piston-speed per minute. The fly-wheel is 148 tons weight, 30 ft. in diameter, and about 15 ft. wide on the face. The Eagley Mill engines, which were recently supplied by the same firm, are the largest single engines in this country, indicating 1,800-horse power. Messrs. Hick & Co. have also in hand engines of 400-horse power, which will be the first ever erected in Baroda, and a short time ago the first set of engines were sent by the firm to Japan.—*The Engineer and Iron Trades Advertiser.*

Locomotive Notes.

By Angus Sinclair.

COMPARING PERFORMANCES OF AMERICAN AND BRITISH LOCOMOTIVES.

A proposal has been made and advocated in influential railroad quarters to have a few leading railroads combine to defray the expense of bringing a good type of British locomotive to this country for experimental purposes. Unrestricted competition has brought the price of transportation to the lowest terms, and railroad managers are eagerly searching for means of reducing working expenses. Locomotive supplies and maintenance form such an important portion of railroad expenditures that any method of improvement which would reduce their aggregate two or three per cent. would be beneficially apparent on the balance-sheet of many a struggling railroad company. Examination of the sheets which show the relative performance of American and British locomotives conveys the impression that our engines are far behind those running in England as regards economy in fuel and other expenses. From this has originated the desire to see a British locomotive placed upon one of our average roads and subjected to a thorough test of its comparative economy and durability under the conditions imposed upon our engines in their ordinary service.

The American locomotive is far from being a perfect machine, and it is susceptible of many improvements before laying claim to the distinction of an economical heat motor; but it is doubtful if any advantage could be gained by remodeling after the ordinary British pattern. The only feature about British locomotives which we could imitate with hopes of decidedly improved results is the open smokestack, and this is practically prohibited by our various State laws. By using a direct passage for the gases of combustion from the tubes to the atmosphere, British engineers are enabled to run their locomotives with much wider exhaust nozzles than ours, which permit the engines to make steam with a lower smoke-box temperature, entailing less waste of heat. Another element of economy comes in by lessened back pressure in the cylinders. Custom has made the cone and netting or other draft-stifling device an essential requisite of American soft-coal burners, and all over the States laws have been framed recognizing that as a proper and necessary precaution against raising of fires. Although the ordinary British locomotive, with its comparatively soft blast, throws no more sparks and raises quite as few fires as the engines smothered by our most approved spark-arresting appliances, no American railroad company could afford to run the unchanged British soft-coal burner, because they would be held responsible for the damage resulting from every fire that occurred within a mile of their track.

In the matter of valve motion, we could gain nothing by adopting British standards. There the stationary link holds about the same place in engineering estimation as does our shifting link on this side of the Atlantic; and as a means of distributing the steam, there is no perceptible difference between the two systems. For high-speed locomotives the Allen valve is well patronized by British engineers, and is considered an important factor in economy; but it is an American invention, although unknown to honor in its own country.

A leading characteristic of British high speed locomotives, as it strikes us, is the enormous size of the driving-wheels.

In this particular there is a decided distinction between the practice of the two countries. On our roads, where trains averaging a speed from 30 to 45 miles an hour are run, engines with drivers about 66 inches diameter are considered capable of getting over the road on time, and master mechanics accordingly perceive no urgent necessity for making changes on their locomotives. British engines having a similar speed to maintain, are constructed with driving-wheels 90 inches diameter, or more. According to the commonly accepted principles of thermodynamics the locomotives with the small drivers ought to make the best record, since, within certain limits, high piston speed is regarded as being conducive to economy of heat. But calculations which apply correctly to stationary and marine engine practice are frequently greatly at fault with locomotives. This may be a case of that kind. The comparative effect of slow and fast exhaust upon the fire may be of much greater consequence as a means of saving or wasting fuel than it has hitherto received credit for. A driving-wheel revolving more than three times each second, implies a blast whose rush is practically continuous, its velocity depending upon the degree of work being performed, and on the size of the exhaust nozzles. Under the most favorable circumstances, the velocity of the gases following the exhaust is very great, and admits of contact with the evaporating surfaces for only a minute period. Any arrangement which will retain the gases of combustion longer in contact with the heating surface would effect a direct saving of fuel, since more of the heat would be absorbed. This effect appears to be produced where the exhaust is slow enough to be seen distinctly pulsating on the fire. Between each exhaust there is a diminished rush of the gases, and the probability is that in these momentary pauses a largely increased percentage of the heat passes to the water.

When a locomotive with driving-wheels 66 inches diameter is run at a speed of 45 miles an hour, the exhaust occurs 15 3 times per second, while an engine with drivers 90 inches diameter only exhausts 11.2 times in the same period. This decrease of nearly 4 exhausts per second must make a vast difference on the fire, which is not all accounted for by the greater volume of steam used in the slow exhausts to do the same amount of work. Accurate experiment might demonstrate the difference to be less than it appears, but the subject is certainly worthy of greater investigation than it has hitherto received. Nor is it necessary to import British locomotives to pursue the investigations. Two standard American engines made from the same templates, one having large and the other small wheels, could quickly settle the question of relative economy were they equipped with the necessary appliances for recording the result of experiments to which they could be subjected.

On an average railroad it is an extremely difficult matter to determine with any accuracy how much work an engine is performing for the coal consumed, unless special appliances are employed to measure the work. Perhaps it is on this account that prejudice is often more potent than merit in deciding on the value of different classes of engines. To get at the real value of appliances intended to promote the economical duty of locomotives, railroad companies should increase their patronage of the indicator and the dynamometer and abandon the current practice of wild guessing. Until means of obtaining accurate information respecting the performances of existing home-made locomotives are put in practice, it is useless to experiment with foreign machines, for we possess no fair basis of comparison.

We learn that the trustees of Cornell University have authorized the establishment of a course in electrical engineering, commencing in September. There is an almost universal complaint of the scarcity of engineers who are up in the application of electricity, and the prospects in this direction for those who can satisfactorily fill the position of electrical engineer would appear, for the next few years at least, to be flattering.

Tests of Constructive Materials.

The following circular has been issued by a committee of engineers designated by the Commissioners of the Chicago National Exposition of Railway Appliances:

To the Civil, Mechanical, Hydraulic and Mining Engineers of North America:

The Commissioners of the National Exposition of Railway Appliances invite your attention to the proposed tests of the strength and quality of substances used in general construction, to be made during the Exposition, from May 24 to June 23, 1883.

That these tests may be full and complete, and of an extended and varied character, engineers who contemplate visiting the Exposition are solicited to bring with them or send specimens of useful substances for the purpose. A record of these tests will be faithfully kept and afterwards published. It is to be hoped that all who can will avail themselves of this opportunity to learn the quality and strength of the material you build with in your respective localities, and without expense to yourselves.

Suggestions from engineers or others, which will promote the efficiency of these tests, are respectfully solicited.

Special working forms of iron and steel are solicited, especially those which are subjected to constant or severe strains or blows.

A first-class prize will be given to the manufacturer producing, by actual test, the best and strongest upset eyebar and upset rod for threading.

Specimens of stone should be in cubes of two inches.

Stone cubes from old structures which have been exposed to unusually deleterious influence are requested.

Specimens of useful wood, of which no tests have been recorded, are requested.

A written description of each specimen sent for testing, including a full account of the mode of manufacture, must accompany it; otherwise no test will be made.

If the specimen is of metal, name the ore it is made from, and describe its manufacture and purpose.

If a stone specimen, give the date when quarried (unless from an old structure and not known), kind of stone, and the location of quarry, naming the town, county and State.

If a wood specimen, give the date of felling the tree of which it is a part, the common name of the wood; also botanical name, if known, the average diameter and height of the species; state whether it is deciduous or perennial, and what, if any, useful purpose it has served in its native region.

All wood specimens should be of the following dimensions: For tensile strength, two by two inches, by three feet long; for compressive strength, six by eight inches by one foot long.

Specimens of rope made from steel or iron, or from manila, hemp, or any vegetable substance, also of belting of every description, are solicited.

Wm. Sooy Smith, C. E.,
K. F. Booth, C. E.,
W. F. Goodhue, C. E.,
Wm. H. Lotz, M. E.,
Chester B. Davis,
Hydraulic Engineer,
Committee.

Wm. Sooy Smith, *Secretary.*

Address all correspondence, specimens, etc., to E. H. Talbott, Secretary, Grand Pacific Hotel, Chicago.

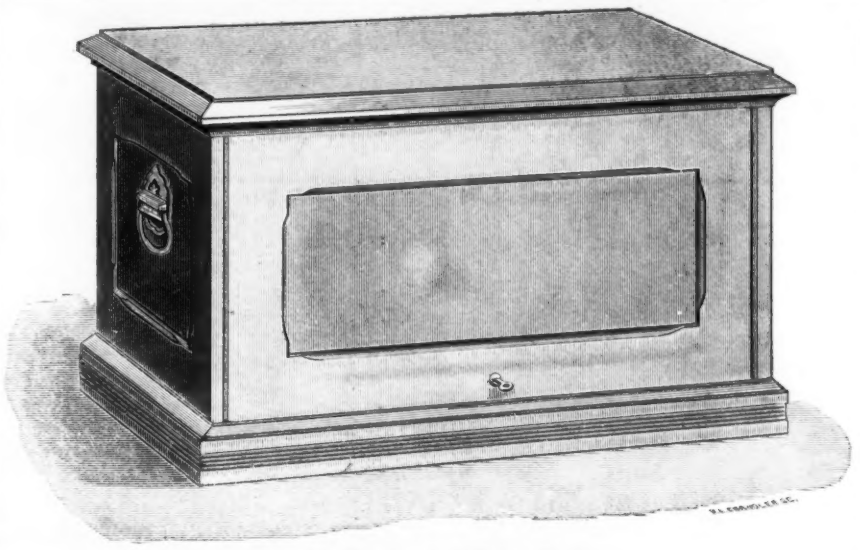


Fig. 1.—Machinists' Tool Chest.

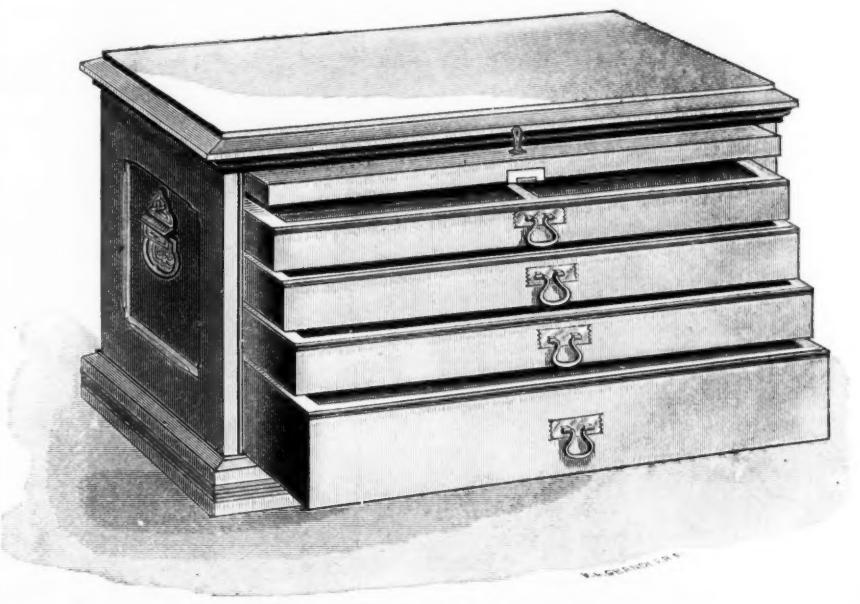


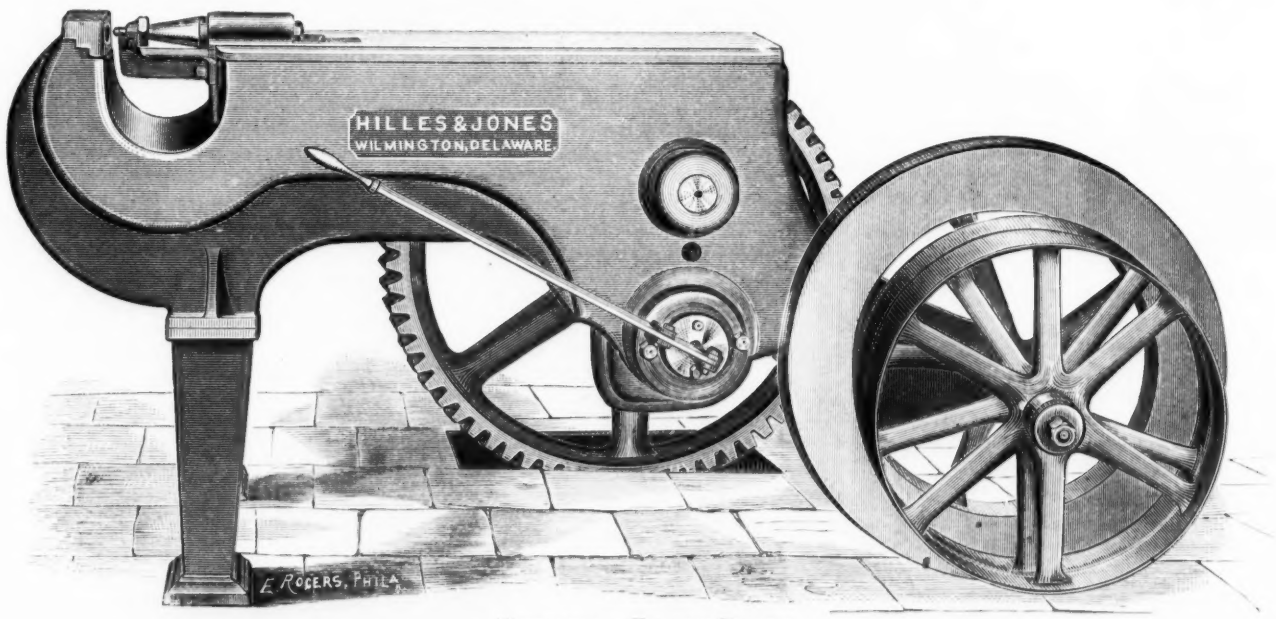
Fig. 2.—Machinists' Tool Chest.

Machinists' Tool Chest or Cabinet.

We present with this, engravings representing a tool chest or cabinet, which although more especially designed for machinists' use, is equally available for watchmakers, jewellers, amateurs, photographers, &c. Fig. 1 shows the cabinet closed, and Fig. 2 shows it opened. The dimensions are, outside, length 21″, width 14″, height 12½″. The drawers are 17¼″ long and 10″ wide, inside measurement. The lower drawer is 3″ deep, the two middle drawers each 1¼″ deep, and the upper drawer 1″ deep. There is in addition a space under the lower drawer 18″ long, 10¾″ wide and 1½″ deep, which may be used for drawings, circulars, &c.

When closed, as represented in Fig. 1, a paneled front covers and secures all the drawers. This front, when the cabinet is opened, slides into a groove in the upper part, so as to be entirely out of the way.

These cabinets are made of black walnut, highly polished. The drawer handles are nickel-plated, and the end handles are bronzed. They are provided with a "Yale" lock with two keys. They are manufactured by Goodnow & Wightman, 176 Washington street, Boston, Mass.



Horizontal Flange Punch.

At a recent meeting of the British Institution of Civil Engineers a paper was read by Mr. H. Tweddell on "The Productive Power and Efficiency of Machine Tools, and of Other Labor Saving Appliances Worked by Hydraulic Pressure." An abstract of the paper appears in *Iron* of March 16th, from which we reproduce the following:

At present, a large amount of lifting was done by manual labor, in which there was room for great improvement. Owing to the necessity hitherto of using belting or gearing for working them, power cranes had only been applied to machine tools to a limited extent as a means for increasing their output. The author pointed out that by the adoption of the portable hydraulic machine tools a great saving in floor space might be effected. The introduction of hydraulic capstans had practically annihilated space in docks and railway yards, and as the haulage of a given weight on a good road required less power than lifting it, an extended application of such machinery to engine works was to be anticipated. The suitability of this system for increasing the output of large engineering shops and ship-yards was evident, and safety in lifting was insured in hydraulic cranes by the impossibility of workmen putting on them a greater load than they were calculated to bear.

On the increased productive power and efficiency obtainable by the employment of hydraulic pressure for working machine tools, the author observed that, so far as the prime mover was concerned, the power necessary in a hydraulic system to pump water into the accumulator was nearly always obtainable from a steam engine; but even at this early stage the hydraulic system, by the use of the accumulator, allowed of a considerable reduction in the size of the motor. A comparatively small prime mover, running continually, stored up sufficient energy to meet any sudden demand from even the largest of the machines worked from it; while, on the other hand, the prime mover would have to be equal to this. This defect was to a small extent met by the use of fly-wheels, which were, however, objectionable from their liability to accidents, and from the strains to which the shafting was subjected. From 200 to 300 blows per minute had been obtained in hydraulic machines, and in machine tools and cranes the acumulator acted as a perfect safety-valve. Then, for the transmission of power to points distant from the prime mover, hydraulic pressure was the most economical. By the use of hydraulic mains laid underground, all overhead shafting was dispensed with. Under the present system, the lines of shafting, to a great extent, regulated the position of the machines. In a recent case, 48,000 square feet were required with shafting, while 32,000 square feet only were necessary when arranged for hydraulic transmission. In this case the cost of all the roofing and flooring of a building 300 feet long, 53 feet wide, and 25 feet high was saved. A pipe of one-inch bore could transmit nearly 6.5 horse-power at a very moderate velocity of water, and a two-inch pipe about 25 horse-power. All danger from the use of belts and pulleys was avoided, and when once laid in the ground it needed no further attention.

Horizontal Flange Punch.

The accompanying engraving represents the horizontal flange punch, built by Hilles & Jones, Wilmington, Del. In the construction of this machine all pulleys and gearing are placed below the framing, so that flanges of any shape can be readily brought into position to be operated upon. Bent angle iron can also be punched from either side, equally adapting the machine for boiler-makers' and ship-builders' use.

These machines are made in five sizes, with jaws from 6″ to 42″ in depth, and to punch iron up to 1″ thick.

A convenient little tool has just been patented in Germany for boring a hole through an opening much smaller in diameter than the hole itself.—*Age of Steel.*

The distinction between the "hole" and the "opening" is not very well explained. Does the tool, in boring the "hole," cut away part of the "opening," or does the "opening" expand sufficiently to let the "hole" pass through? Next time give us a plan and elevation of the hole, with a cross section of the opening, and the necessary specifications, so as to make the w(hole) intelligible. As it now stands it is decidedly an "open" question.

The *National Labor Tribune*, of Pittsburgh, the largest circulated workingman's paper in the United States and an uncompromising advocate of a protective tariff, after noting the concerted action of iron manufacturers in four Pennsylvania towns in reducing the wages of their employes, makes the following comment: "This wholesale reduction business throughout the country will eventuate in the organizing of 'free trade' clubs, as the men will naturally conclude that protection is a farce, as far as they are concerned."

LETTERS FROM PRACTICAL MEN.

Universal Square and Bevel Protractor.

Editor American Machinist:

I send you a sketch of a new universal square and bevel protractor. I think the accuracy and adaptability to a great variety of work of this tool will commend it to mechanics.

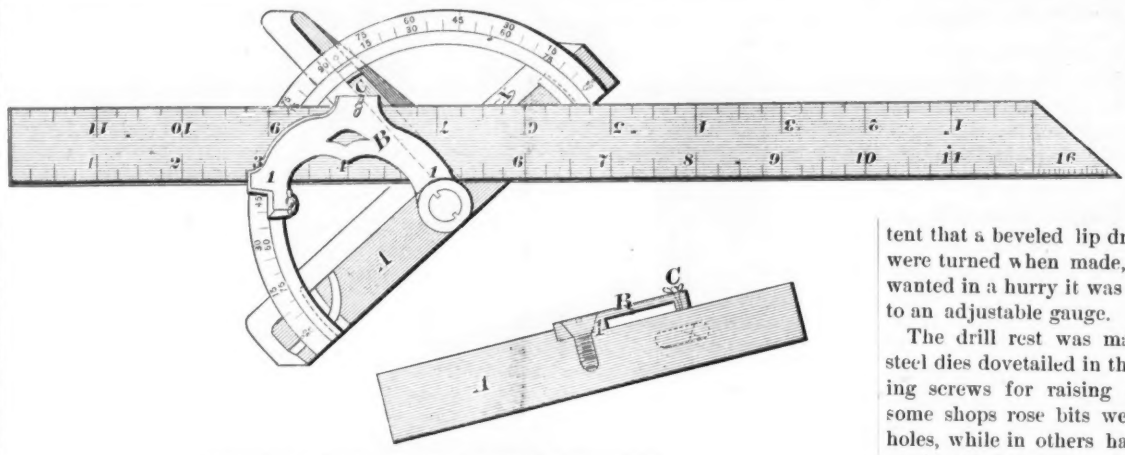
In the engraving, *B* represents a flat piece of steel made to swivel on the piece *A*, being made rigid, as desired, to the graduated arc, by means of a screw, the head of which hooks under the arc. The graduated arc is fastened to part *A*, by means of small screws. The blade slips under the piece *B*, and is secured at the desired angle by means of the screw shown at *C*, which presses a small gib against the edge of the blade, causing it to bind against the shoulder at *I* in piece *B*. By this arrangement an angle much more acute can be determined than by the ordinary tool used for this purpose, since if desired, the blade can be swung around parallel with *A*, when the tool can be used as a key-seat rule.

With the blade set at 45° the tool can be used as a universal square. The insertion of a spirit glass at *X*, makes an adjustable plumb or level.

The large graduated arc increases the accuracy of the tool. After setting at an angle the blade may be moved to any point, or removed and replaced without altering the adjustment. I think the various adaptations of this tool, as well as its accuracy of adjustment, will commend to mechanics who require such a device.

William E. Golden.

Fremont, Ohio.



Universal Square and Bevel Protractor.

Single-Valve Engines.

Editor American Machinist:

I send three sets of indicator cards, taken from an 8″×14″ engine. The cards were varied by changing the load, and those of the same set taken from the two ends of the cylinder at the same revolution.

While I send these cards to dispel the prevalent notion that a common slide valve cannot be made to work as a cut-off valve, and cut off at a point less than about five-eighths the stroke, I hope those who have an idea as to what a card ought to be will not throw them aside without giving them an extra moment's consideration.

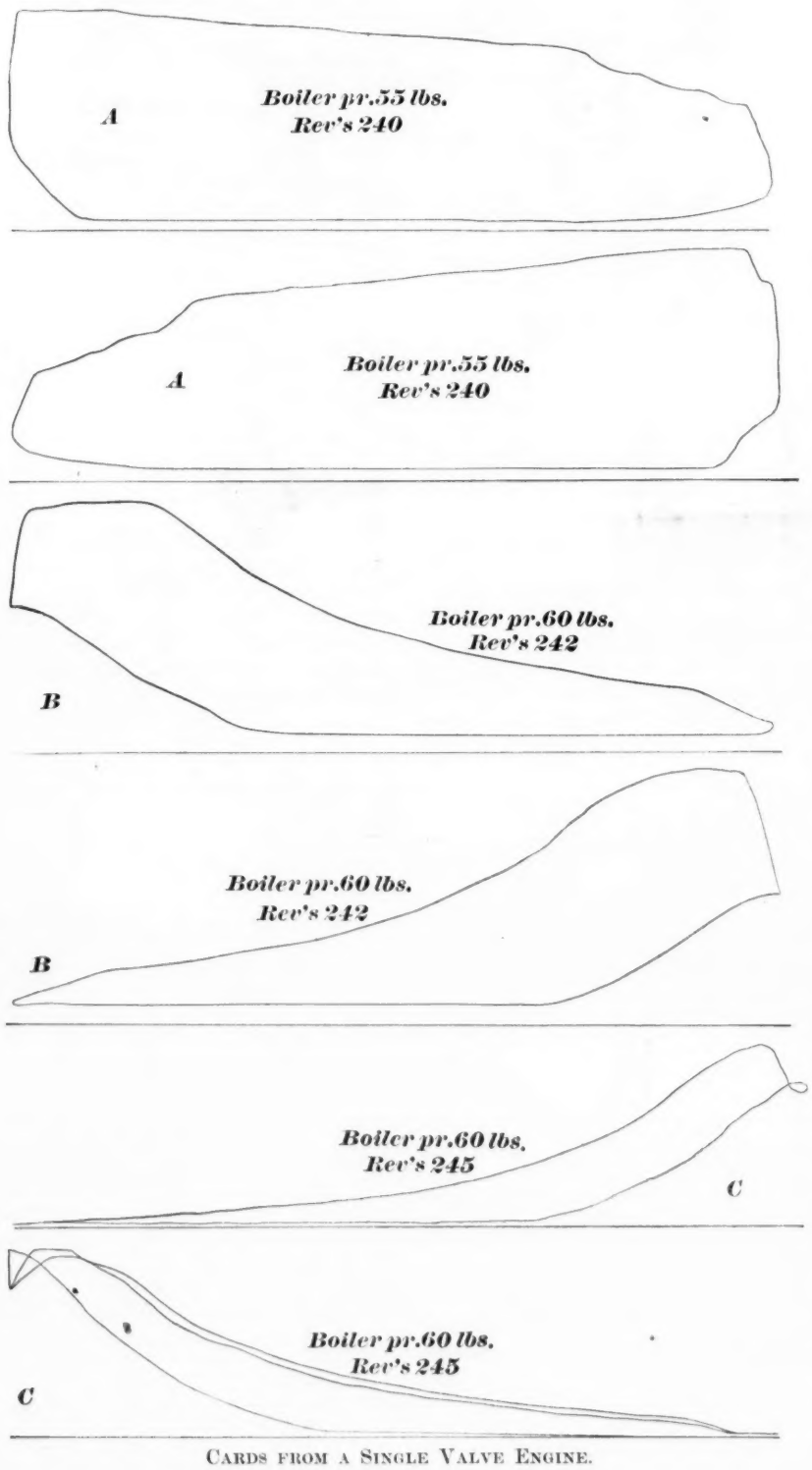
First, they show pretty conclusively that a single valve can be made to cut off at a point so short that the engine will not run away, as well as at all intermediate points out to seven-eighths stroke, or where the engine will do all it can be made to do.

Second, they show that a single slide, if operated in the right way, with a simple eccentric motion, may be made to cut off alike at each end of the cylinder, at all positions from seven-eighths to zero. I should like to have those who are expert at these things figure out how they can arrange the valve and valve motion so as to get any more rotative effect on the line shaft from the steam used at either one of these three positions, regardless of the other positions, and settle their conclusions in per cent., bearing in mind that pressure on the piston above a certain amount, while the crank is on or near the dead center, creates friction without producing rotation, and thus that a card with a vertical admission line is not necessarily one that gives the best results; and also bearing in mind that, at high speed, the indicator pencil, where the engine has a late admission, does not necessarily represent the pressure in the cylinder at that point. That is to say, were the full boiler pressure admitted to the cylinder instantaneously, with an engine running at high speed, the admission line would not be truly vertical.

It will be noticed that, instead of the valve having a constant lead, it is variable, and varies alike at each end, thus giving more lead, more compression and an earlier exhaust when taking steam at full stroke, and a negative lead, with a later exhaust and less compression when cutting off short, than would be possible with a constant lead. This, I think, is a result that will stand investigation, if not criticism. A 40 spring was used in taking the cards.

John E. Sweet.

Syracuse, N. Y.



Cards from a Single Valve Engine.

Chucking Lathes—Flat Ended Drills.

Editor American Machinist:

English builders built special lathes for drilling with flat drills many years ago. The front head stock was single speeded with a large cone and spindle. A narrow belt was run from the spindle, just inside the front bearing, to a long small drum overhead; from this a belt drove a stud on the tail stock. This stud was fitted with a gear that could be thrown in or out of gear with the tail-stock spindle. Two fast and loose head and tail stocks were used on one bed, and one man virtually run two lathes.

The drills were always made square on the ends (for cored work). A truer hole can be drilled with a square ended drill than with a drill with V or beveled lips, for the reason that it will not "run" when it meets a blow hole or an inperfection of any kind, or at least not to the same extent that a beveled lip drill will. The drills were turned when made, but when one was wanted in a hurry it was made by grinding to an adjustable gauge.

The drill rest was made with hardened steel dies dovetailed in the slots, and adjusting screws for raising and lowering. In some shops rose bits were used for sizing holes, while in others half round bits were used with flat cutters held by two screws and adjusted to size by packing with paper. A skillful man will bore to Whitworth gauge every time in this way, but although it looks simple it requires practice, especially in grinding the drills and setting the drill rest. It is a rapid way of doing work, especially where many pieces of a kind are to be made, as in manufacturing cotton and woolen machinery.

J. K. C.

Remarkable Shaft Turning on a Scotch Lathe.

Editor American Machinist:

I see from your issue of March 3d, that Mr. Grant has taken up the matter of shaft-turning, and that he will guarantee to make a lathe to turn over 300 feet of 2″ shafting in 10 hours. My experience of 135 feet in 10 hours is not to be compared to that in quantity, but then the shafting was truly turned to standard gauge. I said 50 per cent. more might be done, if nicety was unimportant, which would make about 200 feet in 10 hours, which is all but up to Mr. Grant's 210 feet actually done.

On reading Mr. G.'s letter I thought I would like really to test the capabilities of our lathe, and the results exceeded my expectations. I experimented with some 2½″ bars, and produced shafting requiring no further finish, at the rate of over 9 feet in 12 minutes, or 45 feet an hour. I continued the experiment for some hours, and turned out finished shafting at the rate of 450 feet in 10 hours.

This could even be exceeded, but then it comes to be a matter of the tools standing, and not of the stability of the lathe.

Wm. Shanks.

Thomas Shanks & Co., Johnstone, near Glasgow, Scotland.

Economy of Naptha as Fuel for Boilers.

Editor American Machinist:

The recent article appearing in your paper entitled "Petroleum as Fuel," has caused me to send you a word in relation to my experience with naptha 71° B., as fuel. It is not my intention to enter into an argument with your correspondent on the subject, but simply to say that it has been my fortune to be so situated in my official capacity during the past twelve years as to render it necessary to use naptha as fuel, and, if possible, to do so with better economy than coal, for the purpose of generating steam. The results of all my work in that direction show that in this locality at least it is a more expensive fuel than any quality or kind of coal, and the best evaporation obtained in a practical test of some weeks, taking records of each twenty-four hours' work separately is 16.12 lbs. water from and at 212° Fahr. for each pound of naptha consumed under tubular boilers of good construction and setting. Naptha.

The Gear-Wheel Question.

Editor American Machinist:

I wish to call your attention to what seems to be an error in your reply to W. B. K., March 31. A wheel 1¾-inch pitch, nearest 4 feet diameter, should have 86 teeth and a diameter of 47.916 inches, instead of having 96 teeth. The largest pinion should have 28 teeth, diameter 15.630 inches, instead of 32 teeth; and the smallest pinion should have 24 teeth, diameter 13.408 inches. This would make the centers 30.662 inches and 31.773.

Adams, Mass. W. B. Yates.

[If our correspondent will look again, he will see that the diameters and number of teeth given were for 1.57-inch pitch, and not for 1¾-inch, and that they were given correctly for this pitch. The reason for naming that pitch was because it came nearer preserving the relative size of all the wheels than a pitch of 1¾ inches. If Mr. Yates will revise his figures, we think he will find the diameter of small pinion, at 1¾-inch pitch, should be 13.368 inches, instead of the diameter given by him. With this correction, of course, the wheels named by him could be used, if desired.]

The McGregor Balanced Slide Valve.

The McGregor balanced slide valve, as represented by the accompanying engravings, is made by Thomas McGregor, 148 High street, Dayton, O. The construction of this valve will be readily understood, as it consists simply of a plain slide placed upon a double ported seat.

This seat has recesses in the middle and at the ends of the ports, which are covered by the plain flat surface of the valve Live steam is let into these cavities, and exerts a force tending to lift the valve from the seat.

This force is more than counterbalanced by the pressure of steam upon the back of the valve, which keeps it in contact with the seat. In this way the friction of the valve in moving back and forth upon its seat is greatly reduced. From the following particulars and experiments sent us by the inventor, the more interesting details of this valve will appear: "The wide difference of opinion among eminent engineers of the problems to be solved in reference to, as well as the functions to be performed by an efficient slide valve, renders it extremely difficult to map out anything in the shape of a conclusive experiment. Some of the best authorities have said that in figuring the pressure of a valve upon its seat it is necessary to multiply the exposed surface of the back of the valve by the pressure upon it in pounds per square inch. Now, I have tried numerous experiments with the model shown in the two perspective views presented herewith. This model consists of a cylinder, with a slide valve of the style shown fitted to it. *P* represents a live steam valve, through which steam is admitted to the steam chest through the valve *G*. Steam can also be admitted under the valve, through the valve *J*, and pipe *M*.

"A stem, with lever attached at the top, permits the operator to apply a force which tends to lift the valve squarely off its seat. A second stem, with lever, is applied at the end, by means of which the valve may be moved to and fro upon its seat.

"By applying a spring balance to each of these levers, the forces exerted may be accurately measured. In this model the back of the valve measures 4.44″ by 5.5″, which, at 40 pounds boiler pressure, would produce 976.8 pounds pressure upon the valve. Again, another good authority says that the pressure upon the back of a slide valve is that due to the area of the ports covered. Now, the area of the ports covered is 4.09 square inches, which, at 40 pounds steam pressure, would be 163.6 pounds pressure upon the valve. Still another good authority asserts that 'it is a difficult matter to arrive at anything accurate or definite, as the pressure upon a slide valve varies greatly, as, for instance, upon locomotives, where, in different positions of the block in the link, the valve covers and uncovers more or less port area.'

"If we take the surfaces in actual contact, as the pressure or the source to which the pressure is due, we will come as near to the true facts as by any other way.'

"All these differences of opinion show a lack of reliable practical information; therefore, such opinions amount to conjecture only.

"The surfaces in actual contact in this model here shown are 7.241 square inches, which, at 40 pounds pressure, would be 289.64 pounds pressure upon the valve.

"Let us compare the figures of some experts. The first example herein alluded to has reference to the entire exposed surface of the back of the valve. This surface in the model would cause a pressure of 976.8 pounds upon the valve. The second example has reference to the area of ports covered, which would cause a pressure of 163.6 pounds upon the valve; while the third example gives this pressure as 289.64 pounds upon the valve. The question now is, Which is right?

"The difference between the first two authorities here quoted is about six to one, and between the first and last more than three to one.

"Such discrepancies are rather curious, so let us see what we get in actual experiment. The model was prepared for an experiment as follows: The stem through the top of the steam chest was screwed into the back of the valve then carefully packed. It will therefore be seen that by raising the right hand end of the lever the valve will be lifted from its seat. The distance from the fulcrum to the center of the pin through valve stem is one inch, and all the holes are one inch apart center to center. The horizontal valve stem was then removed and the hole stopped. A steam gauge was attached to the pipe *H*.

"The water of condensation was drained from the pipe *M*, and cavities under the valve by the cock *N*.

"All being ready, steam was turned on at *P*, *J* being closed, and the cock *N* wide open. The gauge indicated 40 lbs. pressure within the steam chest, which pressure was carefully maintained. A new and accurate 24-pound spring balance was secured and was first hooked into the 8″ hole. An application of the full capacity of the scale at this point failed to raise the valve. It was successively tried in each hole until at length when the 17″ hole was reached where a force of 24 pounds raised the valve from its seat. This experiment was several times repeated to prove its correctness. The area of the valve is 24.42 square inches, as previously stated, and if the pressure upon the back of the valve is due to that area at 40 pounds, it should take, according to our authority, a force of 976.8 pounds to raise it from its seat. The lever being graduated in inches by the holes, a pull of 24 pounds at 17″ from the fulcrum would by multiplying 17×24=408 pounds raised. This, so far, is believed to be clear.

"To determine theeffect of pressure under the valve face, the vertical stem was removed, the hole stopped and the horizontal stem replaced by screwing it into the valve, after which it was packed. By moving the lever back and forth the valve was compelled to move with it. Without pressure above or below it moved apparently without friction. Steam was then admitted into the steam chest at 5 pounds pressure which causes the valve to move a little stiffly. 10 pounds makes it move harder; at 15 pounds the valve showed a resistance that endangered the stem, while an application of 40 pounds rendered it impossible to move it by ordinary fair means. By opening the valve *J*, steam was admitted below the valve, filling the cavities and relieving the load upon the valve to such an extent that the valve moved quite easily. The area of the chambers is as follows: The middle ones on the outside 1.1″ by 2.625″ then 2.625″×1.375=3.609. The small chambers at ends of ports are 8.75″ by .19″, of which there are four, then 19″×8.75×4=6.65″. The sum of all the chambers is 10.049 square inches, which with 40 pounds per square inch exerts an upward pressure of 401.96 pounds. The weight of valve with a pressure of 40 pounds upon it is as stated 408 pounds, while the chamber pressure is 402 pounds nearly, leaving a slight excess of pressure to keep the valve in contact with its seat. The 408 pounds is about 41 per cent. of what would be due to the area of the back of the valve, which would be 976.8 pounds, and the area of the chambers is about in the same proportion to the back of the valve; or in other words, the chambers are 41.19 per cent. of the back of the valve, while the weight of the valve with 40 pounds steam pressure upon it is 41.79 per cent. of that due to the back of the valve at 40 pounds pressure, a slight difference in favor of top pressure. The valve by this process is floated upon the steam pressure under it.

"This device is not an imaginary one, but has been and is now being used with entire satisfaction upon a number of engines. Some of the problems connected with this valve are very interesting ones.

"The device, as will be seen, is quite simple and does not interfere in the least with the economical design of slide valves or interfere in the least with the general construction of the engine."

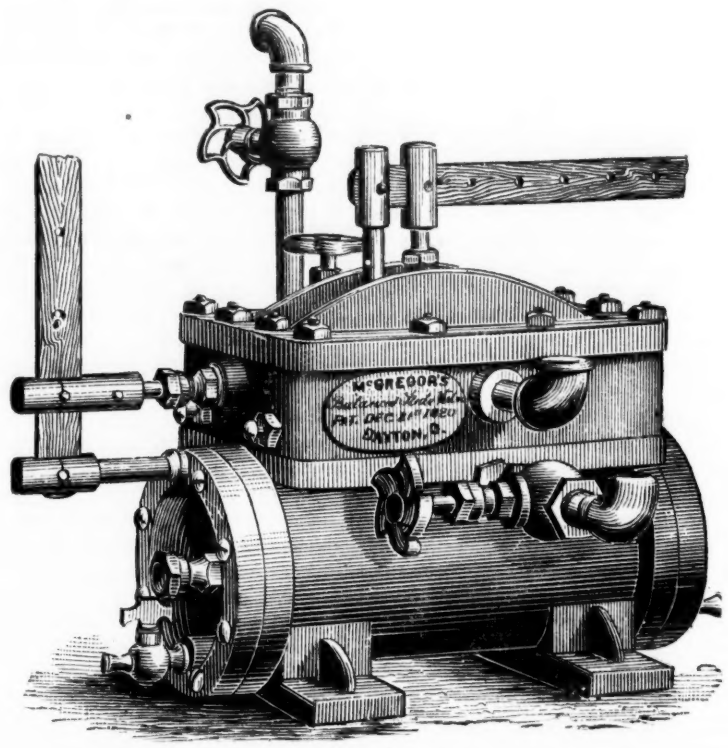
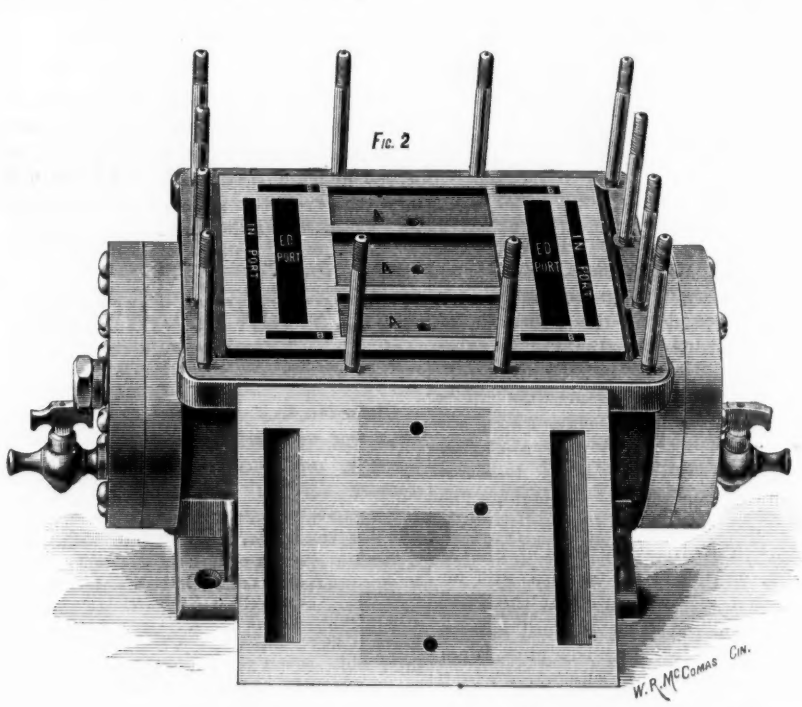
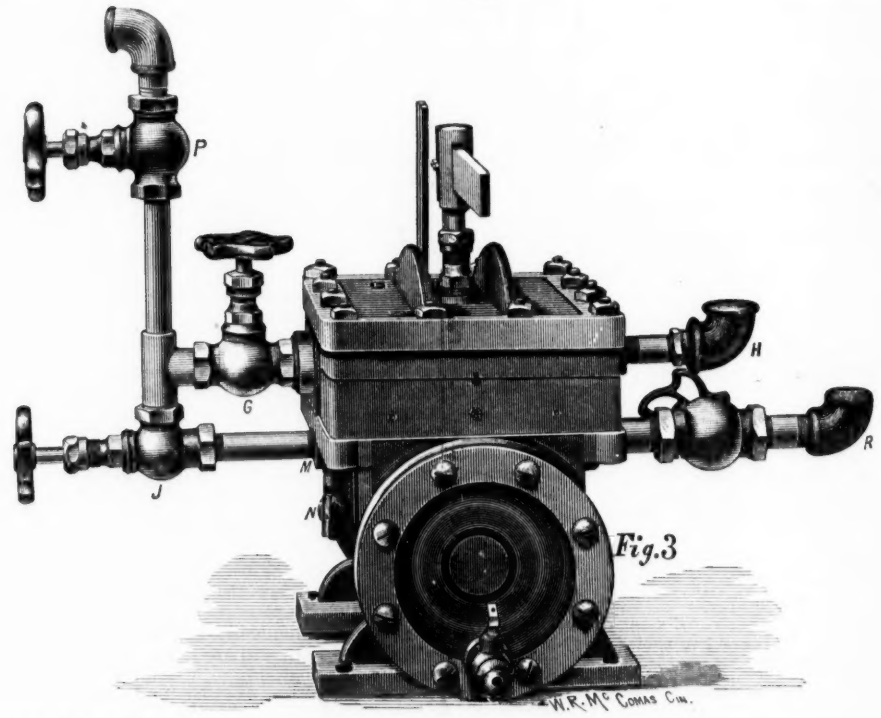


FIG. 1.





MCGREGOR'S BALANCED SLIDE VALVE.

AMERICAN MACHINIST

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NEW YORK, APRIL 14, 1883.

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How English Manufacturers Regard Our New Tariff.

The fact that nearly all tariff legislation by Congress, which promotes the extension and enlargement of our manufacturing industries thereby affording remunerative employment to more workers for wages, and increasing our national wealth, is regarded with strong disfavor by British manufacturers is interesting and significant to every American. This feeling on the part of our trans-Atlantic cousins is not prompted by envy or malice, for there are no hostile feelings except such as are inseparable from rivalry in the same commercial business.

The matter for contention is whether consumers of manufactured goods in this country shall supply their wants *more* or *less* with foreign articles of the kind that can be produced here. With a tariff protective in fact as well as in theory, but a small part of such commodities will be imported from Europe; our industrial establishments will be busy, workmen well paid and general business prosperous, unless other and extraordinary causes interfere. With a tariff reduced below rates that will safely protect, capital will not actively seek investment in manufactures, markets will be supplied with foreign goods, workmen who are fortunate enough to be employed must accept low wages, while thousands of others will be tramping about searching for employment. It is the old, old story told a thousand times, and just as true now as when the protective tariff was enacted over twenty years ago.

No attempt is made to conceal this truth in England. The London *Ironmonger*, the representative journal of the British iron and metal manufacturers, in first commenting upon our new tariff, says:

Where the duties are reduced we may be certain that the American manufacturers in corresponding industries will strain every nerve to *meet the new conditions, by reducing wages* or in other ways, so that it by no means follows as a matter of course that lower duties *must* result in increased business for us. The tendency will be in that direction, nevertheless, and our manufacturers will doubtless not be idle in doing their best to *utilize the opportunities so afforded* to the best possible advantage.

The few reductions in our tariff seem to have aroused great hopes in England. In its next subsequent issue the *Ironmonger* says:

It would, perhaps, be premature to assert that the effect of the altered duties will be to immediately yield great results to British manufacturers, but it is a reasonable assumption that it will do something in the way of improving our exports to the great Republic on the other side of the Atlantic.

* * * * * * *

The United States may not yet see the folly of protectionism, and it may be many years before they throw off the Customs taxes which burden their people, but they are, to say the least, beginning to tire of ultra-protection, and are manifesting uneasiness in connection with a system which makes the many pay for the benefit of the few. Every step they take, consequently, must needs be watched with deep interest by the people of this country, who are so closely allied with their cousins over the water. This feeling would be deep-seated in any case under the circumstances, even if no direct benefit whatever were likely to accrue to ourselves. It must, therefore, be all the more intensified when *it seems likely that our pockets, as well as our sentiments, may receive encouragement and satisfaction.*

Those who are in sympathy with British manufacturers, and who desire what is outlined in the above extracts, are clamorous for lower duties, and are obstreperous in their denunciation of "the folly of protectionism." Those, however, who are opposed to industrial suicide as a national policy—happily the great majority of American citizens—are firm in demanding no further tariff concession to foreign manufacturers.

We are constantly receiving questions and other communications unaccompanied by the writers' names. They all find their way promptly into the waste-paper basket. If a writer wants to receive attention at our hands, he can very easily do so by giving his name and address. His name, however, will not be published without his permission.

Why Some Inventors Come to Grief.

A taste for inventing when it once takes firm root in a person is very fascinating. An individual is first impressed with an idea which at first is vague and indefinite, but by turning it over in the mind it soon assumes a definite form, and the originator becomes convinced that he has struck a happy lead which if properly developed will make him a rich man.

It frequently happens that at first only a few odd hours are given to experiment, with a little spare change, but before long his regular business is to some extent neglected, and all the money that he can possibly spare is expended in developing the new idea. He sits up late at night working upon his models, and retires with his head so full of his inventions that his rest does him very little good. The next day while engaged in his regular occupation he is suddenly fired with a thought of some new detail of his invention, and at once begins to sketch it out upon paper so that he may not lose it. Thus it goes from day to day, gradually encroaching upon his regular business until finally the latter ceases to be remunerative, and he is compelled either to give it up or drop his invention. He looks around among his friends and persuades some one to advance him an amount which he claims will be sufficient to build an experimental machine. Having matured his plans and completed the drawings, he proceeds to a machine shop owned by a prominent builder of steam engines, and perhaps astonishes the proprietor by the announcement that he has made a decided improvement upon the Corliss valve gear for steam engines. The proprietor looks a little amused and asks to see the drawings, to which the inventor makes no objection. In answer to questions the inventor says that in the first place he does away with the "plug valves" used upon the Corliss engines, and uses flat slide valves instead. Next he does away with the wrist plate with its complications of arms, rods and pins.

The eccentric is also done away with and instead of all the foregoing (as he claims) objectionable things he has a large number of gears, cams, tripping devices, *ad infinitum*. When his elaborate description of the new valve gear is completed, the proprietor inquires if he is sure that the Corliss valve is of the plug type, and he promptly answers "yes," and at the same time admits that he has never seen the inside of one, nor had any experience in running a Corliss engine, and in fact has never been an engineer at all, nor even a mechanic. The proprietor then takes him out into the shop and shows him the construction of the valves. A more surprised man it is difficult to find when he discovers that the valve (which he supposed from outward appearance of the cylinder must be a plug) is not a plug at all, and that the objections which he had taken for granted must necessarily exist are purely imaginative. The proprietor then good-naturedly explains and illustrates to him how the valve, which had been mistaken for a plug, is nothing more nor less than a slide valve shaped into a circle, and that it is one of the best forms of balanced valve, without complication, ever made. He also explains why so little power is required to operate the valve. While this explanation goes on the inventor stands with eyes and mouth wide open, and when it is concluded drops his drawings exclaiming, "I am a ruined man!" This is no fancy picture, but is "taken from life."

It is sad when the inventor has developed his invention into a condition where he feels sure of its success, to have his fondest hopes blasted by learning that he has spent his time and money, as well as ruined his business in striving to produce a thing for which there is no reasonable demand, and in attempting to overcome difficulties that do not exist.

Too many inventors begin a course of expensive experiments without suitable deliberation. When they get an idea that seems novel they at once make application for a patent, without thinking about its true practical value, or once asking themselves whether the contemplated improvement is really an improvement and if it will have any permanent commercial value.

There have been many good things produced by inventors which, although novel and exceedingly interesting, have no actual market value simply because no one will pay for them.

Literary Notes.

A TREATISE ON APPLIED MECHANICS, by Henry T. Bovey, M. A., with numerous diagrams and examples. In two parts. Price, $3.50. Published by John Lovell & Son, Montreal, Canada.

This treatise on applied mechanics is written principally for those who have had the advantages of a thorough mathematical education in its higher branches, and involves a free use of the calculus. Part 1 contains definitions and general principles as to the strength of materials, as contained in chapter 1, while chapter 2 treats of the strength and stiffness of beams, and chapter 3 of the transverse strength of beams. Chapter 4 treats of resistance to compression, as relating to pillars; chapter 5 of resistance to torsion, and chapter 6 on the strength of hollow cylinders and spheres. This concludes part 1. Part 2 is composed of six chapters, on the following subjects: frames, roofs, bridges, suspension bridges, arched ribs, and details of construction. These books are well written, and clearly printed upon good paper, and the high standing of the author would seem to indicate that they will meet with approval among advanced mathematicians and engineers.

POCKET LOGARITHMS, to Four Places of Decimals. Including logarithms of numbers, and logarithmic sines and tangents to single minutes, to which is added a table of natural sines, tangents, and co-tangents. Price, 50 cents. Published by D. Van Nostrand, 23 Murray street, New York.

This little book comprises No. 65 of Van Nostrand's Science Series. It is intended as a pocket book for civil engineers in field work, but, like other similar books, may be used wherever such tables can be applied.

Questions & Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(136) H. L., Sacramento, Cal., asks: 1. Can I straighten or turn a shaft too long to go between the centers of my lathe? *A.*—By using a "cat-head," as described in the article: "To Turn a Shaft Properly" in the American Machinist of March 31, and a center rest, you can straighten the shaft and turn all but a short piece at each end, held in the chuck; or you can arrange to drive the shaft on the head center from a pin in the end of the shaft and take the thrust on the center rest, and turn entirely to the end. 2. Why is an explosion likely to occur when the steam valve between two boilers, one of which is cold and the other has steam on, is opened? *A.*—Such a proceeding would be dangerous for several reasons; for instance, so suddenly heating the cold boiler might cause rupture, suddenly reducing the temperature of the hot boiler would be bad, or the water might all be taken from the hot to the cold boiler, allowing the hot boiler to be burned.

(137) A. A., Owen Sound, Ontario, writes: I have an engine 5″×6″ running at 300 revolutions per minute, with 60 lbs. steam pressure. I wish to load the engine heavily. The fly-wheel weighs 140 lbs. 1. Is it heavy enough? *A.*—You do not give the diameter of the fly-wheel. Assuming it to be 20 inches, it would be better if it were 100 lbs. heavier. 2. Would it be an advantage to put a heavy wheel on the countershaft, which runs at 75 revolutions? *A.*—It might help the matter a little, but not very materially. The additional weight should be in the engine fly-wheel. 3. I intend driving the countershaft by gearing from the crank-shaft. The pinion I intend using has 22 teeth, 2¾″ face, and the wheel on countershaft has 88 teeth. Are they strong enough? *A.*—You neglect to give the pitch of the gears, without which your question cannot be answered. Assuming the pitch to be one inch, by shrouding the teeth they will be strong enough. 4. Will driving with gearing be as satisfactory as a belt? *A.*—We should prefer a belt. 5. I propose to use a "Barton" machine for cutting barrel staves from ash and elm. Will I have

sufficient power? *A.*—We are not acquainted with the machine named, but should suppose your engine would be rather small.

(138) M. W. F., Kansas City, Mo., writes: I have an engine 9″×14″ running 125 revolutions. It has a double slide valve connected by bridges. The steam ports are 11-16″×8″, exhaust ports 1⅜″×8″, bridges ¾, travel of valve 2½″. The steam and exhaust pipes are 2″. We run with 60 lbs. steam pressure. The engine pounds on the center, and you will see there is no lap on the steam side of the valve. The exhaust lead is 3/16″. The eccentric is keyed to the shaft. Can I add lap to the steam ends of valve, and if so, how much? *A.*—If you are not mistaken in your statement, your valve is badly proportioned. Such a valve could have 9-16″ steam lap, and then open a full port for the admission of steam. We should say a good proportion for the valve would be: steam lap 9-16″, exhaust lap 3-16″. It would be better if steam pipe was 2½″ and exhaust pipe 3″.

(139) F. F., Port Allegheny, Pa., asks: 1. Which will develop the most power—two engines 12″×26″, or one engine 24″×26″? *A.*—The 24″×26″ will develop about twice the power that the two 12″×26″ engines will. 2. If I run the exhaust pipe in a stream of water, will it relieve the back pressure, and will it result in saving steam? *A.*—You will not be likely to find any saving.

(140) O. F. M., Quincy, Pa., asks: What should be the dimension of valve and ports of an engine 2″x4″? *A.*—You can make steam ports ¼″x1½″; exhaust port, ½″ x 1½″; steam lap of valve, 3-16″; exhaust lap, 0; travel of valve, 1″.

(141) C. F. D., Pottsville, Pa., asks: Who was the first to turn the exhaust steam from a steam pump into the suction, and when was this arrangement first used? *A.*—We are unable to answer the question of our correspondent. If any of our readers can do so, we shall be pleased to hear from them.

(142) M. S., Middletown, Ohio, asks: Which of the following will work the easiest—a screw cut 1″ pitch, double thread, driven from an 18-toothed gear, the gear on the screw having 35 teeth, or a screw ½″ pitch, driven with mitre gears? *A.*—The last mentioned screw will have a slight advantage.

(143) A. F. W., Howard, R. I., writes: I am burning, for steam heating purposes, 3,000 lbs. of coal per day, and assume that 1 lb. of coal evaporates 9 lbs. of water, or that 27,000 lbs. of water are evaporated into steam at 50 lbs. boiler pressure. On this assumption, how many cubic feet of steam of that pressure am I using? *A.*—A pound of water will occupy, in steam of 50 lbs. gauge pressure, about 6.34 cubic feet; hence the number of cubic feet of steam in 27,000 lbs. would be 27,000×6.34=171,180.

(144) A. F., Charleston, S. C., writes: I have a double plunger pump, that I use for feeding hot water from heater to boilers. One of the plungers is 2½″ diameter, and the other 3⅛″. The stroke is 2½″; speed, 72 revolutions per minute. Will you please tell me the capacity of my pumps, supposing everything to be tight, and also how you obtain it? *A.*—The area of the 2½″ plunger is 4.9 inches, and the displacement per stroke is 4.9×2.5=12.25 inches The area of the 3⅛″ plunger is 7.66 inches, and the displacement 7.66×2.5=19.15. The displacement per stroke of the two plungers would be, 12.25+19.15=31.4 cub. in., or 31.4×72×60=135,648 cub. in. per hour. The number of cubic feet per hour would be, 135,648÷1,728=78. This is on the supposition that the pump works perfectly, but there will be some loss from the barrels not filling entirely, and from some escape before the valves close. This loss, if the valves are in good condition, may amount to 10 per cent.

(145) L. L. E., Trinidad, Col., writes: I am about to set a boiler of the following dimensions: Length, 22 feet; diameter, 48″; 4 flues, 9½″ diameter. What I wish to know is: 1. How much below the boiler should the grate be? *A.*—For coal, 18″ to 24″. 2. What space should there be between the bridge wall and boiler? *A.*—You can make the space 7″. 3. What space should there be between the wall and back end of boiler? *A.*—For convenience of getting in, 2 feet is a good distance. 4. How large should the combustion chamber be? *A.*—Unless you make special arrangements for introducing air at the bridge wall, you can start from behind it, about level with the grate, and slant up 6″ or 8″ in the run to the back end of the boiler. It makes but little difference exactly what this space is. 5. What should be the length of the grate? *A.*—Five feet will be a good length. 6. The stack is 42 feet in height. Is it high enough? *A.*—It would be better if it were twice that height.

(146) F. H. T., Rockville, Conn.: 1. How can I calculate the horse power of an oscillating engine, 3″×3″, at 300 revolutions per minute, 80 lbs. gauge pressure? *A.*—The fact that it is an oscillating engine will make no difference in calculating the power. The area of a 3″ piston is 7″, and the piston speed is 150 feet per minute. You ought to realize a mean effective pressure of 40 lbs., on which supposition the indicated horse power will be:

$$\frac{7\times40\times150}{33000}=1.27.$$

The proper way to determine the power of your engine is by means of the indicator or friction brake. 2. Do you calculate differently when the steam is cut off early in the stroke? *A.*—Yes. By the aid of hyperbolic logarithms, you can calculate the mean effective pressure for any point of cut-off. You will find this explained in any modern work on the steam engine. 3. What is the simplest way of reversing the motion of an oscillating engine? *A.*—That will depend entirely on the construction of the engine. 4. What will prevent case-hardened iron from rusting? *A.*—Cover with oil or varnish, to protect it from moisture.

(147) A. J. P., Southbridge, Mass., asks: If a flue over the top of a boiler is detrimental, what better would it be to set a boiler as indicated in the following extract, and then fire with wood, causing a sheet of flame to encircle the boiler? "Again it is not only unnecessary but positively detrimental to close in the side walls at the middle of the boiler. We never close in lower than the base of the dome, and it is still better to carry the wall clear over, leaving a jacket space, that is, keep the walls 4″ away from the shell at the side, and after getting above the middle, turn an arch clear over, keeping away from the shell 6″ to 10″. At the front end the brick is closed in on the shell for a foot all around, and at the back end it is also closed in above the level of the top row of tubes. It will be seen that no draft or flame can pass above the middle of the boiler, but the upper space becomes filled with *dead gas, at a moderate heat and without oxidizing properties.*" *A.*—It may be possible that for some special case it would not be advisable to set a boiler as indicated, but they are set in this way for almost all kinds of fuel, and we have never heard of bad results from it.

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Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

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Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

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For a strictly first-class automatic engine of from ten to sixty horse power, address, The Straight Line Engine Co., Syracuse, N. Y.

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For sale or exchange for a small engine lathe, one 4½ H. P. Herreshoff Yacht Engine. Address, L. Coppleston, Nyack, N. Y.

Boiler Scale.—Parties having fine specimens for sale or loan, for exhibition, address Jas. F. Hotchkiss, 84 John street, New York.

Pattern Maker's Assistant. By Joshua Rose. 324 pages, $2.50 by mail, postpaid. Address orders, P. O. box 3,306, New York City.

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Chordal's Letters.—John Wiley & Sons, 15 Astor Place, New York, have now ready a new and enlarged edition, with six additional plates, of Chordal's Letters, comprising the choicest selections from the series of articles entitled "Extracts from Chordal's Letters," which have appeared in the columns of the AMERICAN MACHINIST; with a steel portrait of the author, and upwards of fifty original illustrations by Chas. J. Taylor. One volume 12 mo. of nearly 400 pages, cloth, $2.00. Will be mailed and prepaid on the receipt of the price.

MANUFACTURES.

Tuscaloosa, Ala., is to have another cotton factory.

In Detroit, Mich., the machinery business is a little dull.

Roanoke, Va., wants an iron foundry, according to the local newspaper.

A Pennsylvanian intends to erect a new large blast furnace in or near Birmingham, Ala.

A party at Atlanta, Ga., has secured the $50,000 necessary for the erection of a rolling mill.

The machinery business in Chicago has become more conservative than it was a few months ago.

The machinery trade in St. Louis has been quiet since the opening of the year 1883, and competition is sharp.

A foundry for the manufacture of hardware is soon to be put in operation at Downington, Chester county, Pa.

C. L. Weston, Seventh avenue, New York City, is having a six-foot boiler set with the Jarvis furnace, to burn screenings for fuel.

The new works for the manufacture of barbed wire fencing, to be erected at Beaver Falls, Pa., will cost half a million dollars.

The citizens of Liberty, Va., are organizing a joint stock company for the establishment of an extensive woolen factory there.

Clemens Vonnegut, hardware dealer of Indianapolis, Ind., has added machinists and mill furnishing supplies to his trade.

The American Brake Co., St. Louis, Mo., have started to erect a machine shop, 75x130 feet. The force of workmen will be considerably increased.

P. D. Cooper, late general manager of the N. Y. P. & O Railroad, offers to subscribe $10,000 towards $50,000 capital for a paper mill at Beaver Dam, Wis.

The Excelsior Brewery, St. Louis, Mo., are setting two more boilers with the Jarvis furnace, to burn slack coal mixed with hops. This is the second order.

The firm of Bauer & Dietz (bolt cutting and nut tapping machinery) Cincinnati, Ohio, has lately dissolved. The business will be continued by J. Dietz & Co.

In addition to the new Britannia Works soon to be erected at Southington, Ct., a new silk mill, 75x40 feet and two stories high, will probably be built in that town this spring.

Thomas Stewart, of Philadelphia, with a number of capitalists of New York, has organized a company for the manufacture of fibre-lined paper. The works are to be located at York, Pa.

The town of Medway, Mass., has unanimously voted to abate the taxes for five years on a manufacturing business to be started there by the Hon. Lyman A. Cook and others of that town.

A large plow factory is to be started in Minneapolis, Minn., by a company with ample capital. E. A. Hendrickson, of St. Paul, and Parent & Smith, of Minneapolis, are among the projectors.

Hall & Brown, manufacturers of wood-working machinery, St. Louis, Mo., have begun to erect a foundry, 80x60 feet. Twenty-five men will be employed, and castings will be made about the middle of April.

A. J. Davis, Newark, N. J., has just finished, upon an order, eleven hoisting engines for the Pelham Hod Elevating Co., and fifteen hoisting engines for Peter H. Walsh, both of New York City. He is still well supplied with orders.

J. W. McFarland, Alliance, Ohio, is having quite a boom in the manufacture of his single-headed, wide-belt axle lathes, shipping them to Coshocton, Ohio, and other new works starting up in the manufacture of wagon and carriage axles.

Benjamin Eastwood, Paterson, N. J., has added to his works a new brick building, 40x50, four stories, and filled it with new machinery. He manufactures silk machinery, machinists' tools and bobbin machinery. About 75 men are employed.

The mills at Lowell, Mass., though heavily furnished with steam-power, have, in some instances, suffered slightly by the low water in the Merrimac river. The Boott Mills have for some time had a portion of their work stopped on this account.—*Boston Commercial Bulletin.*

The Valley Iron Works, Williamsport, Pa., write us that they are working fifteen hours a day, yet are unable to fill all orders. They are bringing out a new double gang edger and 100 horse power engine. Circular saw mill trade is good, and the general outlook is promising.

The National Pipe Bending Co., New Haven, Conn., have built a new brick building, 132x40, two stories, for the purpose of manufacturing their brass coil feed water heaters. This concern is just now getting under way, having commenced building about the 1st of December.

The Woodruff Car Trust Co., recently formed at Pittsburgh, Pa., will construct parlor and hotel cars under the Woodruff patents, to be leased to any line of railroad, on yearly payments, with interest, and at the end of ten years the leasing company obtains sole possession of the cars.

A number of leading English iron and steel manufacturers have written that they propose to visit Tennessee during the latter part of March for the purpose of making a thorough investigation of the mineral resources of that State, with a view of investing largely in the manufacture of iron and steel.

William Tolhurst, Troy, N. Y., is shipping a large order of laundry machinery to Rome, Italy. He will accompany it to superintend its erection. His shop is kept busy at present on laundry and broom machinery, and on an order for fine die work for moulding a new plastic substance, said to be superior to celluloid.

June Manufacturing Company, Chicago, Ill., are so driven with work they have been obliged to increase facilities, both in shop and tools. They expect to be in their new quarters, corner of LaSalle and Ontario streets, May 1st. Mr. Hughs, superintendent, is now getting up the tools to make Hewitt's Giant Screw Wrench.

The Alexandria (Va.) Mining, Manufacturing and Warehouse Co. has recently been organized to endeavor to make that city a manufacturing center. The Virginia Midland Railway Company is particularly interested in the project, on account of the iron ores, manganese, copper and other minerals along the line of its road.

S. S. Hepworth & Co., manufacturers of centrifugal machinery, of New York City, have erected a new foundry and machine shop at Yonkers, N. Y. The foundry is 50x100 feet, and is just being fitted with a 42-inch cupola, two center cranes, and a traveling crane. Work will be started this week, but the machine shop will not be in full working order before May 1st. H. W. Harris, of New Brunswick, N. J., has accepted the position of foreman of the foundry.

Germany now possesses twenty-two locomotive works, four of which manufacture engines for narrow-gauge roads. The annual production of the eighteen others is about 1,730 engines. Prussia alone turns out 1,060 locomotives. Berlin has three shops, making 45; Hanover has one establishment, which furnishes 200 locomotives, and Hesse-Nassau one, which manufactures 150 annually. The annual production for narrow-gauge roads is seventy. Switzerland can make 350.

The Ritchie & Dyer Co., Hamilton, Ohio, have more orders for their traction engines than at any other time within a year, and inquiries are more numerous than ever before. They have adapted their regular road engine to run on rails, thus making a cheap and efficient locomotive. Mr. Ritchie, of this company (formerly superintendent of the Owens, Lane & Dyer Machine Co.) claims to have made the first successful American road locomotive above thirteen years ago.

The Oskaloosa (Ia.) Power & Land Co., propose to put in a plant of four 250-horse power engines for the purpose of renting power. They will use slack coal, which, it is claimed, will make power at one-half its equivalent in any other shape. They will erect for renting, adjoining the power-house, a single-story building, having ten rooms, 40x80 feet each. At the other end of the power-house, lots of any size wanted can be rented for any purpose. The plant will be ready about August 1st. Manufacturing establishments in Oskaloosa are made free from taxation for five years.

The *Springfield* (Mass.) *Republican* says: The settlement of the tariff question has given Berkshire manufacturers a decidedly hopeful countenance, and there are already more signs of activity, especially in the north part of the county, than for some time before. The Adamses begin to feel it, with their large cotton goods enterprises, but no such "boom" will be experienced this season as in the past two or three years. The iron interest also begins to feel the benefit, and the Lanesboro furnace will, it is said, go into blast, as will also some of those of the Richmond Iron Company.

A new rolling mill is in course of construction at Toledo, Ohio, by a company known as the Maumee Rolling Mill Co., with $500,000 capital. H. S. Walbridge is the president; I. Droege, vice-president and general manager; H. S. Worthington, treasurer; E. H. Van Hoesen, secretary. They expect to be in operation by the end of the year. The capacity will be one hundred tons. The main building will be 362x100 feet, with forty feet of shed on either side. Other buildings are the foundry, 60x54 feet; the machine shop, 64x32 feet, two stories; and the office, 44x35 feet, two stories.

"The Champion City Illustrated" is the title of a pamphlet issued from the office of the *Springfield* (Ohio) *Republic*. The largest manufacturing establishments in the city are the five engaged in making Champion mowers and reapers, viz.: Whitely, Fassler & Kelly, The Champion Machine Co., Champion Bar & Knife Co., Champion Malleable Iron Co., and Warder, Bushnell & Glessner. Taken together, they form the most extensive agricultural machine shops in the world. The new shops of Whitely, Fassler & Kelly will employ over 2,000 hands. "A good idea of the immense size of this workshop," says the *Republic*, "may be obtained by imagining a building almost seventeen thousand feet in length by sixty feet in width, a continuous room three miles and over in length. A machine a minute is the capacity of this huge institution. Imagine, if you can, that at each minute tick of your chronometer a complete Champion machine is rolled from the stocks and housed or shipped to its destination; six hundred machines from sunrise to sunset—an annual production of one hundred thousand implements." Included in this establishment will be a large rolling mill and steel works.

Machinists' and Engineers' Supplies.

New York, March 29, 1883.

Considerable business has been done in the supply line during the past week, and the leading machine tool builders are quite busy. There has been a tendency recently, on the part of some dealers to cut prices to effect sales, but, with such exceptions, prices remain unchanged. The feeling is good.

Rhodes & Hays, Hartford, Conn., have reduced the price of their ratchet screw-driver from $3 00 to $2.25.

Iron and Metal Review.

The Pig Iron Market continues weak, and consumers persist in holding off in anticipation of still lower prices. Indeed, there seems to be a slight tendency in that direction. The tone of the market is hardly what might be termed steady.

We quote Foundry, No. 1, $24 to $24.50. Foundry, No. 2, $21.50 to $22.50. Grey Forge, $18 to $19.

The demand for Foreign Iron has been extremely light during the past week. Importers feel but little encouragement to accumulate any stock at their own risk, as there is very little profit upon imported iron at present. We quote Coltness at $24 to $24.50. Glengarnock, $22 to $22.50. Gartsherrie, $24 to $24.50. Summerlee, $24 to $24.50. Carnbroe, $22. Eglinton, $21 to $21 50 Langloan, $24 to $24.50. Damellington, $21.75 to $22.

Wrought Iron Scrap is in fair demand at $26.50 to $27 for prime selected from yard, and $25 ex-ship.

The Steel Mills are receiving a few large orders, but prices remain unchanged. Old Rails are dull at $28 for Double Heads, and $23 50 for Tees. Merchant Bar is fairly active at 2c. to 2¼c., list prices.

Copper continues dull and weak at 17¼c. Banca Tin 22c.; Straits and Malacca, 21¾c. to 22c; Billiton and Australian, 22¾c. to 23c; English Lamb and Flag, 22¼c. to 22¼c; English Refined 22¼c.; Spelter, Common Domestic, 4.65c. to 4⅞c.; Refined, 8c. to 8¼c.; Lead 4.60c. to 4.65c.; Refined, 4.70c.; Antimony, Hallett's, 9¾c. to 9⅞c.; Cookson's, 10¾c. to 10⅞c.

WANTED

"Situation and Help" Advertisements, 30 cents for each seven words (one line) each insertion. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

Wanted—Two good machinists at the Orange Co. Furnace, Middletown, N. Y.

Wanted—By an experienced tool-maker and general machinist a position as superintendent or foreman. Address, T. M., Box 12, Am. Machinist.

Wanted—A draughtsman accustomed to tool work, who has had shop experience. Address, Vega, Worcester, Mass.

A mechanical engineer, now superintendent, desires a position as draughtsman, superintendent or manager. Address, M., American Machinist office.

A mechanical engineer, thoroughly competent to erect and start a "wire mill," desires an engagement. Address "Steel Wire," care Am. Machinist.

Wanted—Position as foreman by competent machinist. Manufacture of specialties preferred. No objections to country. Address, H., care T. Burchall, 117 North Morrow St., Wilmington, Del.

Wanted—A machinist fully competent to build steam engines and general machinery. Must be a strictly sober man. Give age, references, etc. Address, Salem Iron Works, Salem, N. C.

Mechanical Draughtsman experienced in sewing machine work, electrical machinery, &c., having excellent references from first-class houses, desires a position near the city. Address, D., Box 1, American Machinist.

Wanted—Machinists. Strictly first-class vise hands and fitters. Experienced men, accustomed to machine tool work, can obtain steady employment at liberal wages. Address, Niles Tool Works, Hamilton, Ohio.

Draughtsman of theoretical knowledge, and long practical experience in the construction of marine and stationary engines, sugar plantation machinery and general mill work, is open for engagement; will go anywhere for a reasonable salary, where engineering is wanted. Address, Draughtsman, care American Machinist.

Wanted—A position as superintendent or foreman, by a moulder of long experience, competent to take charge of a first-class iron foundry. Eighteen years' experience as foreman in construction of steam engines, pumps, presses, hydraulic machinery, turbine wheels, grist and saw mill work, etc. References furnished. R., Box 2, Am. Machinist.

Light and fine interchangeable machinery to order. Foot and power lathes; slide rests, &c. Catalogue for stamp. Edwd O. Chase, Newark, N. J.

Wanted—Second-hand three or four hundred lbs. steam hammer. Address, Cherry Grove Iron Works, Garfield, Warren Co., Pa., stating condition, cash price, and name of maker.

A large manufacturing corporation, exceptionally favored in its location at tide water, in successful operation for over forty years, is desirous of increasing its business by taking up specialties of established utility and merit, in either wood, iron or composition, light or heavy work. Correspondence solicited from parties interested. All communications treated confidentially. Address, A., care Am. Machinist.

BOOKS —RELATING TO— Steam Engines, Machinery, Heat, Gas, Electricity, Casting and Founding, &c.

DESCRIPTIVE CATALOGUE, 100 PAGES, 1883, SENT FREE ON APPLICATION.

E. & F. N. SPON, 44 Murray St., N. Y.

FOR SALE.

We have the following second-hand Machinery for sale, viz.:

One Iron Planer, to plane 24 feet long, 62 in. x 62 in. square. It is powerfully geared, heavy and in good order.

One Planer to plane 15 ft. long 51" wide very good.

One Iron Planer, to plane 12 feet long, 36 in. x 32 in. in fair condition.

One Iron Planer, to plane 12 feet long, 30 in. x 30 in.

One Pit Lathe face plate 6 feet dia., with internal wheel full dia., external wheel 88 in. dia., quadruple geared, will turn 10 feet dia. and 22 in. face in pit, swing 60 in. over ways, 48 in. over carriage, 21 ft. 6 in. between centers. All complete.

One Engine Lathe, will take 14 feet between centers, and swing 53 in over ways, has hollow spindle, and is adapted for both turning and boring, with countershaft. Complete.

One Engine Lathe, will take in 11 feet, 6 inches between centers, swings 48 inches over shears, and 32 inches over carriage. It has internal gear, and cross-feed, with countershaft. All complete.

One Slotting Machine, 12 in. stroke, slots to the center of 46 in. Adjustable table and universal feed motion.

One Combined Power Punch and Shears, to punch ⅝ and ½, and shear ½ in. iron.

One Axle Lathe, Fitchburgh Machine Co.

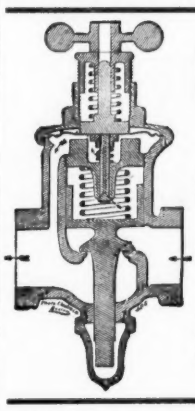
One 13 in. Shaper, Lowell Machine Shop.

One No. 1 Brown & Sharp Screw Machine.

Two 4 in Spindle Drills.

One Pond's double Miller.

The George Place Machinery Co.,
121 CHAMBERS AND 103 READE STREETS, NEW YORK.



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Pressure Regulator
For Steam, Water and Air,
MANUFACTURED BY
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12 CORTLANDT ST., NEW YORK.
AGENTS FOR

The Waters
Perfect Governor.
Having Adjustable Speed, Automatic Safety Stop, Sawyer's Lever, and Solid Composition Valves and Seats. Also
SUPPLIES
For Machinists, Railways, Mills, Mines, &c.
Please send for circular and state that you saw the advertisement in this paper.

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Skinner's Patent Steam Pile Hammer, automatic; very effective; simple and durable, with recent improvements.
VULCAN IRON WORKS,
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BUFFALO PORTABLE FORGES.
The Lightest, Strongest, most durable, easiest working, and in every way
The Best Portable Forge Made.
BUFFALO FORGE CO.
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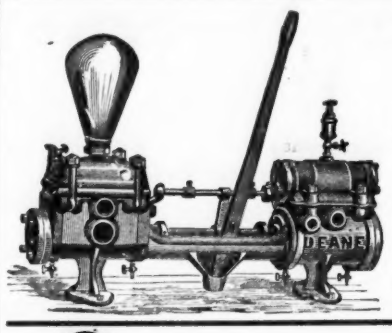
FOR SALE.
One Iron Planer. Planes 42 inches x 12 feet. Built by New York Steam Engine Co., 1873.
E. P. BULLARD, 14 Dey Street, New York



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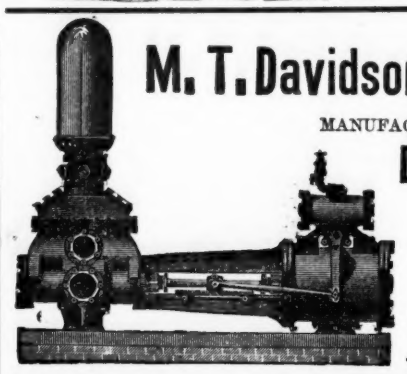
92 & 94 Liberty St., NEW YORK. 54 Oliver St., BOSTON. 226 & 228 Lake St., CHICAGO.



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OFFICE & WORKS:
41 to 47 KEAP STREET, BROOKLYN, N. Y.
Warranted the Best Pump made for all Situations.
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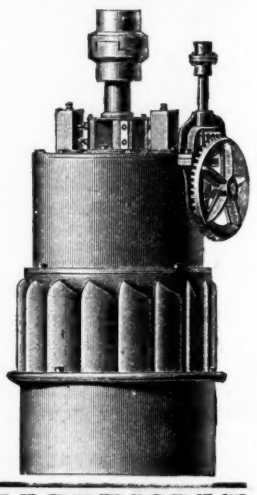
THE HERCULES TURBINE
Gives more power for the same size, also better average results from full to one-half gate than any other water wheel ever made. It is moderate in cost, compact in form, and not liable to get out of order.



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SHOPS AT
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Send for Catalogue, Circulars and Price List to either of the above places.

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Is the Standard of Excellence
AT HOME AND ABROAD.
THE A. S. CAMERON
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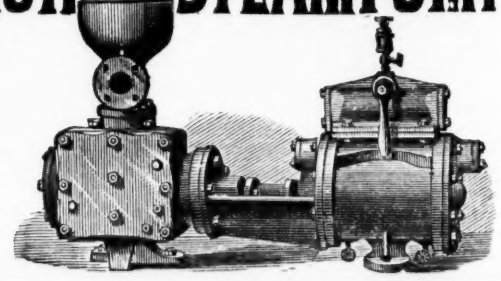
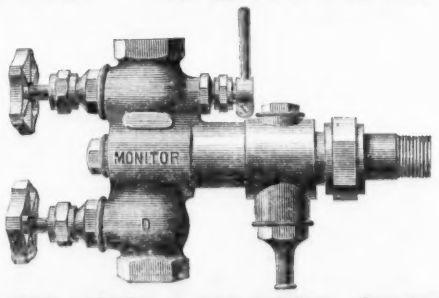


THE "MONITOR."



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For Conveying Water and Liquids.
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MANUFACTURERS OF
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of all descriptions, and of a great number of sizes; including also,
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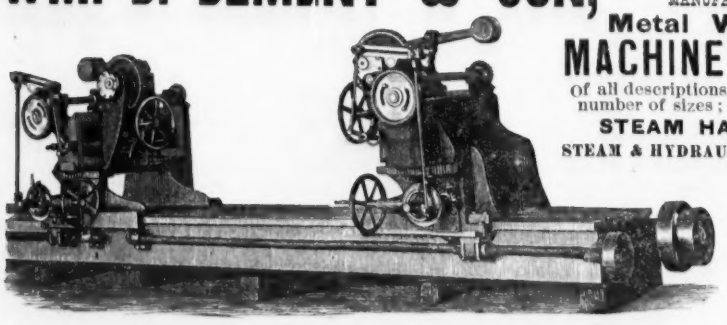

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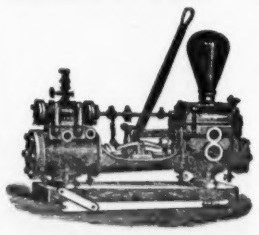

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TESTIMONIALS ON THE MERITS OF THE

PATENT NICKEL-SEATED "POP" SAFETY VALVE.

CLEVELAND, O., May 11th, 1882.

CONSOLIDATED SAFETY VALVE CO.,

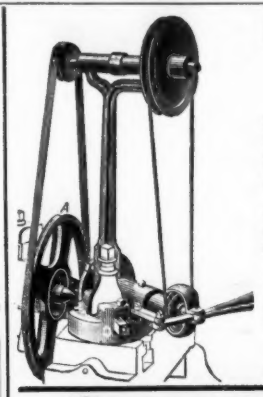
111 Liberty Street, NEW YORK.

GENTLEMEN:—Replying to yours of the 6th inst., I have handled your Nickel-Seated Valves for past seven years, placing them on a *large number of boilers*, and watching their operation closely, and never had a customer who has had any trouble with them, or known of any of the valves failing to open promptly at the pressure they were set to blow at. Your valves are capable of doing more than you claim for them,—a 2½ inch "Pop" working at 50 pounds of pressure, or upwards, will relieve a 75 H. P. boiler of all the steam it can generate; which is more than an ordinary safety valve, 4 inches in diameter, can do, to say nothing of its liability to corrode and stick on its seat. In short, I would not put an ordinary valve on my own boiler, and only under protest on a customer's.

Yours Respectfully,

T. R. BUTMAN,

Gen'l Manager Butman Furnace Co.



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For truing hardened centres and keeping true, without removing from lathe, or drawing temper.

Simple, quickly adjusted to any lathe, and does its work perfectly.

Price complete, with emery wheel, boxed, $15.

Send for circular to

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With Steel Screws. Lathe Made and Hardened.

When ordering, state as above, whether a full set or a set of 12, or smaller set of 8. Those dogs prefer them to any other make.

This dog is very heavy, and is warranted not to break with any work

No. 1	3-8 in.	....	$ .50
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" 9	1 3-8 "	....	1.10
" 10	1 1-2 "	....	1.10
" 11	1 3-4 "	....	1.25
" 12	2 "	....	1.40
" 13	2 1-4 "	....	1.60
" 14	2 1-2 "	....	1.60
" 15	3 "	....	1.80
" 16	3 1-2 "	....	2.00
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Full set, 19 Dogs, 26.35

No. 20	5 1-2 in.	...	4.25
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Small set of 8 dogs from 3-8 to 2 ins., $7.30.

No. 14	2 1-2 in.	...	$1.60
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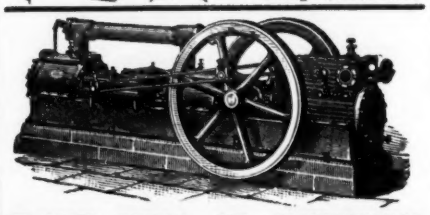
Set of 12 from 3-8 to 4 inches, $15.00.



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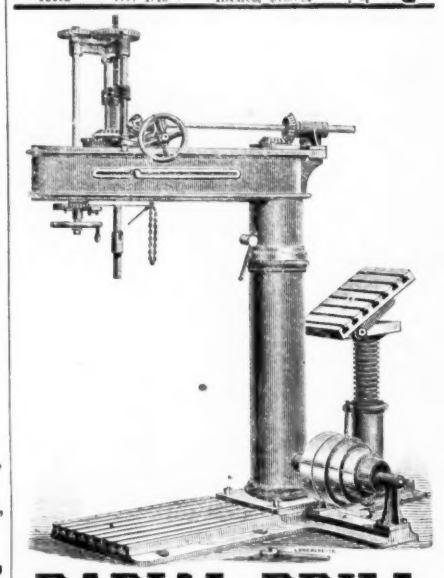

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ASBESTOS LIQUID PAINTS, ROOF PAINTS, ROOFING, STEAM PIPE AND BOILER COVERINGS, FIREPROOF COATINGS, CEMENTS, ETC.

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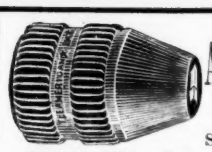

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We make a specialty of compounding oils for high-speed engines and all purposes not in the ordinary line of machinery.

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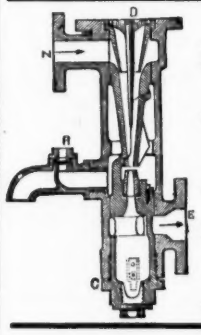

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UTILIZES A POWER HERETOFORE THROWN AWARY.

Works automatically at a steam pressure of less than half a pound. Adapted to all pressures.

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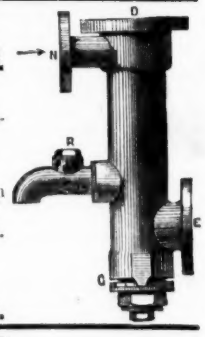

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PATENT HOT POLISHED SHAFTING.

Superior to any shafting in market for the following reasons, viz.: 1st.—It is perfectly straight and round. 2d.—It can be rolled accurately to any desired gauge. 3d.—It has the beautiful blue finish of Russia Sheet Iron, rendering it less liable to rust or tarnish than shafting of the ordinary finish. 4th.—It will NOT SPRING or WARP IN KEY SEATING like most of the other manufactured shafting sold in the market, and, as a consequence, is admirably adapted for LINE AND COUNTER SHAFTING. 5th.—The surface is composed of MAGNETIC OXIDE OF IRON, forming a superior journal or bearing surface. 6th – It is made of superior stock.

Sizes made from 7/8 to 3½ inches, advancing by sixteenths. Price lists, with references and other information, furnished on application to

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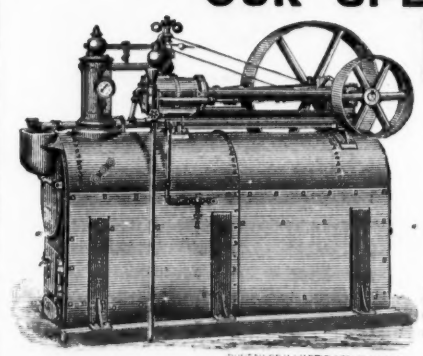
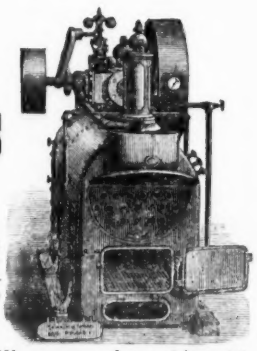
OUR SPECIALTY IS Economical Powers

Of 5 to 25 H. P.





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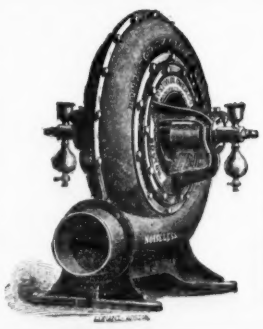

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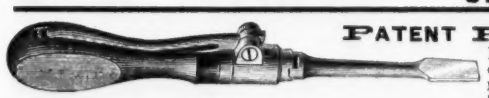

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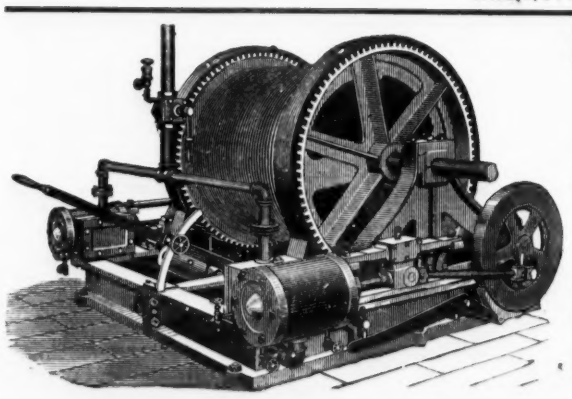

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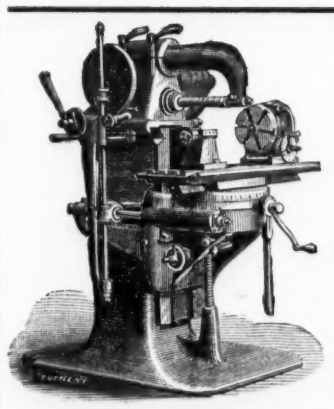

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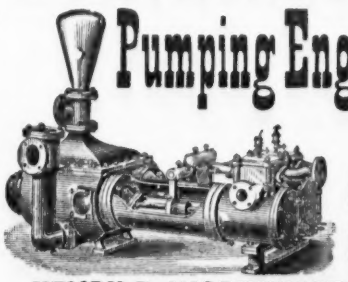

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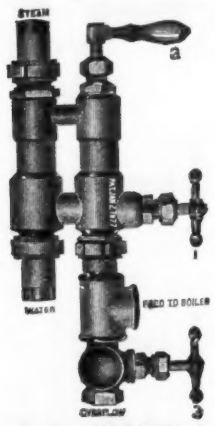

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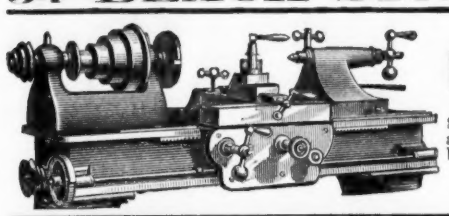

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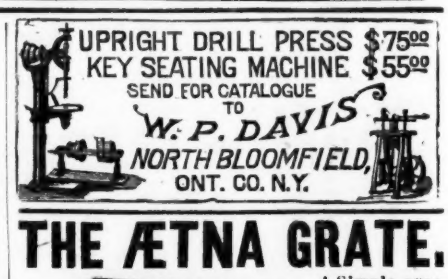

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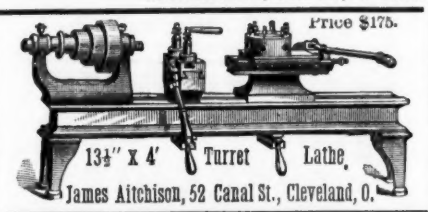

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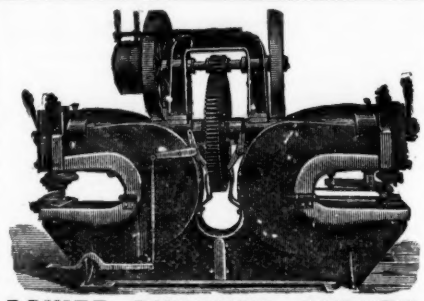

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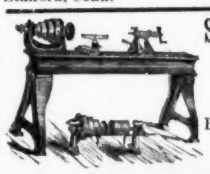

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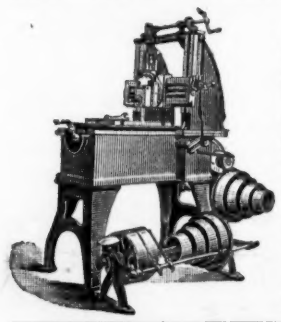

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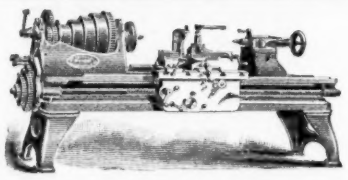

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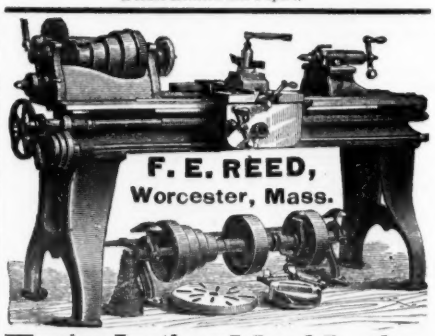

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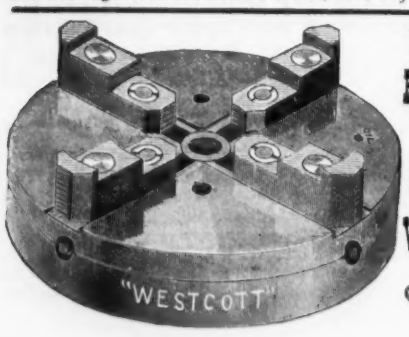

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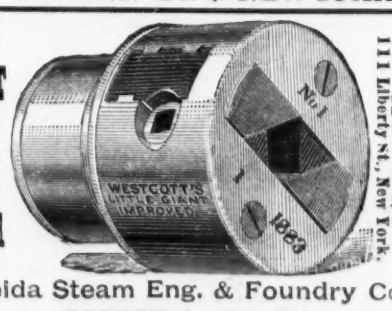

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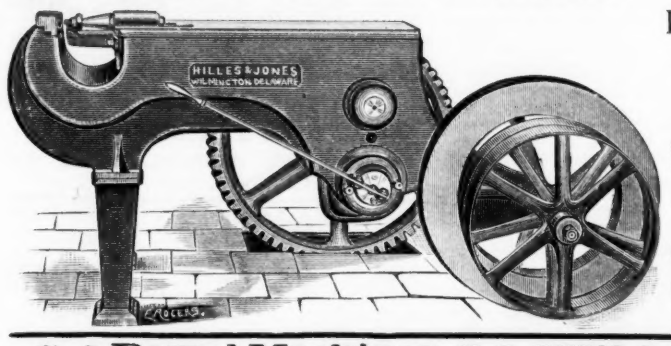

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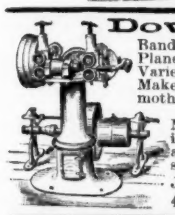

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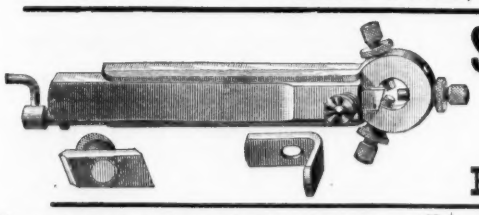

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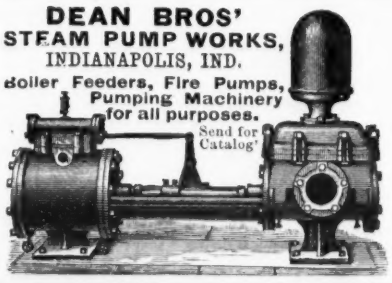

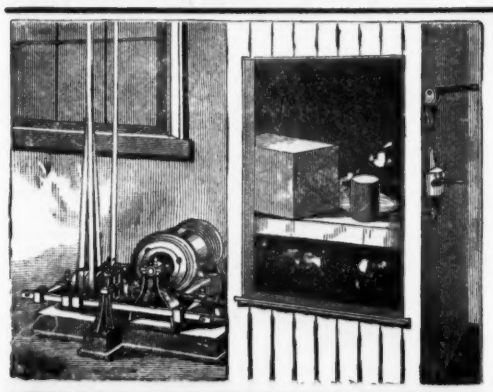

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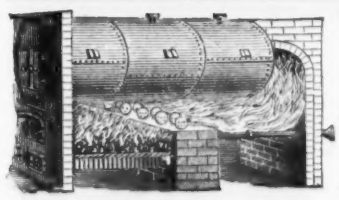

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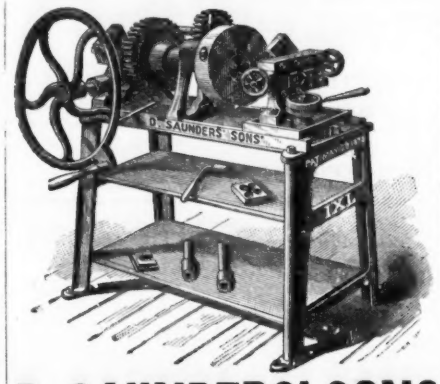

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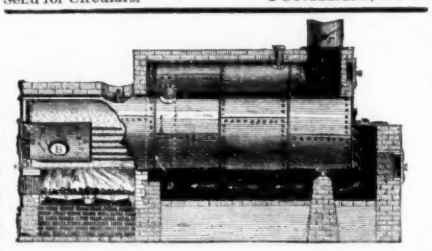

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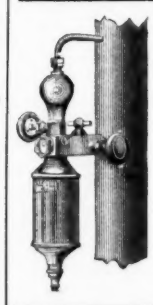

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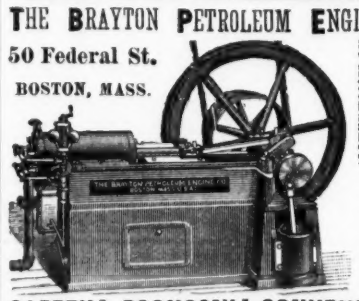

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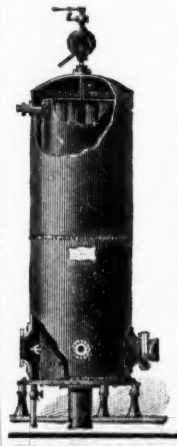

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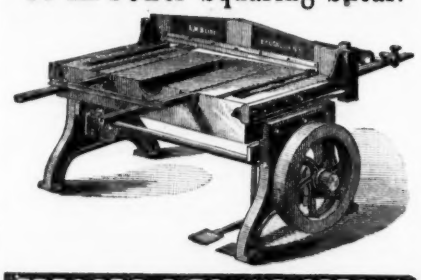

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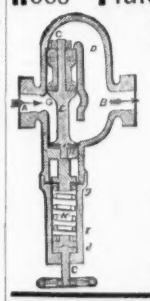

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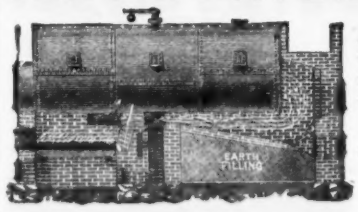

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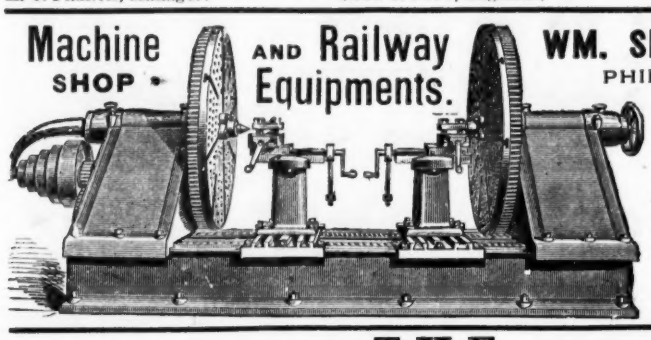

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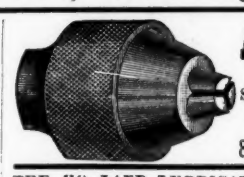

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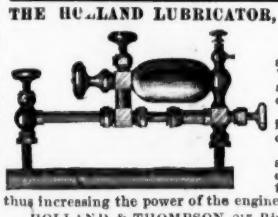

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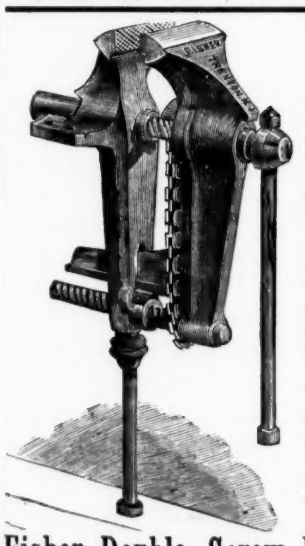

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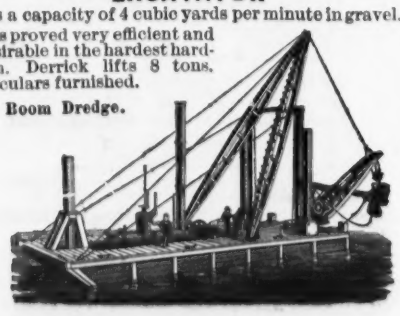

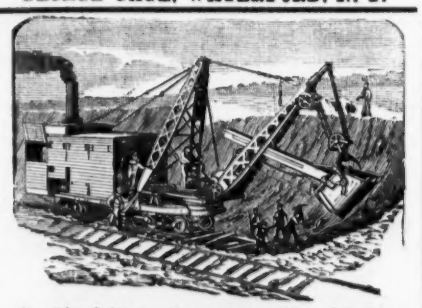

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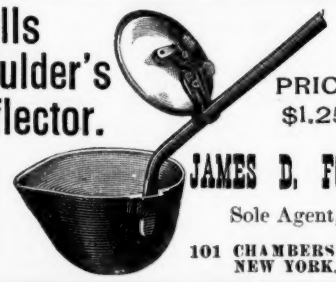

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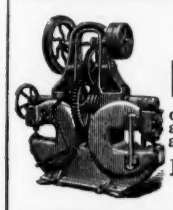

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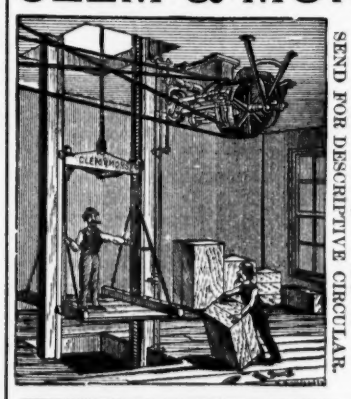

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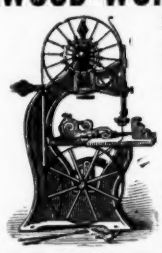

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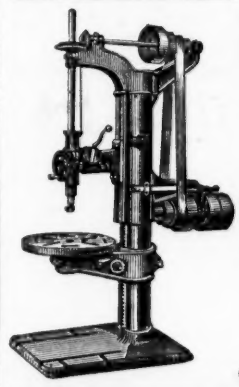

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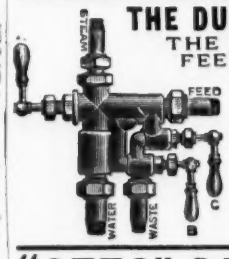

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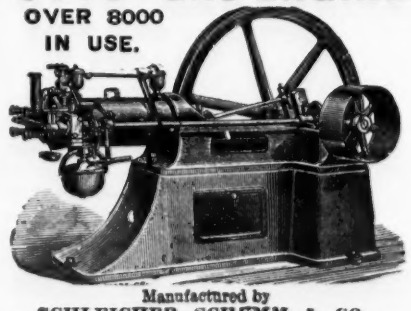

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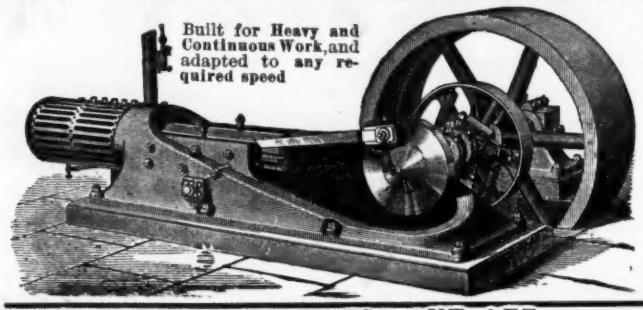

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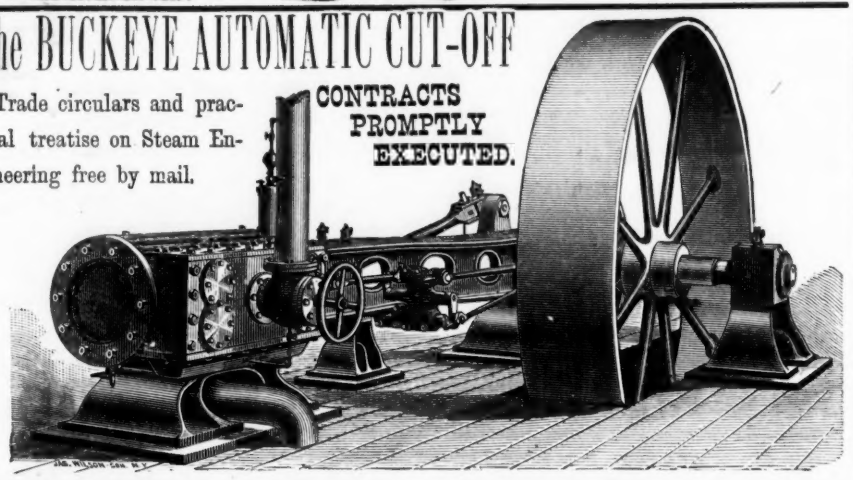

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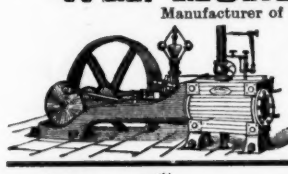

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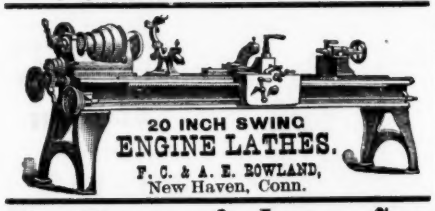

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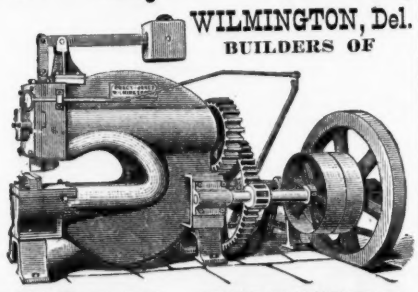

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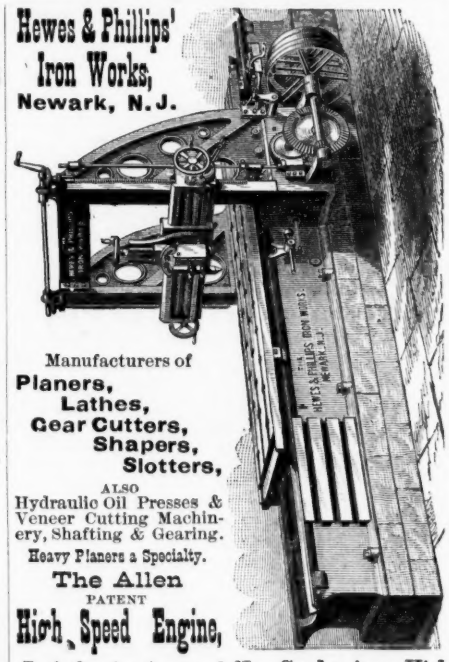

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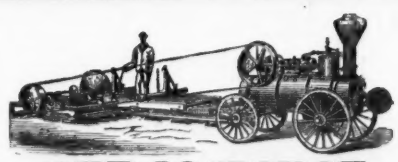

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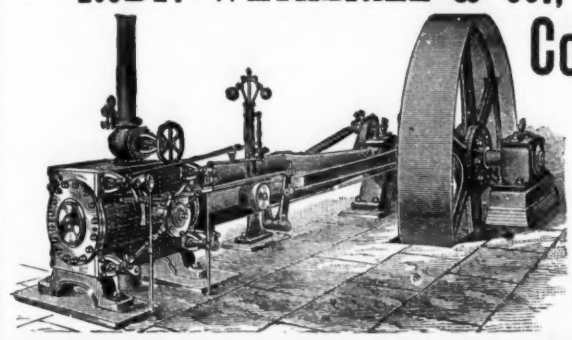

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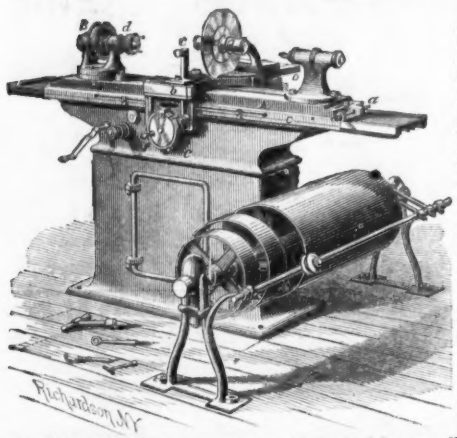
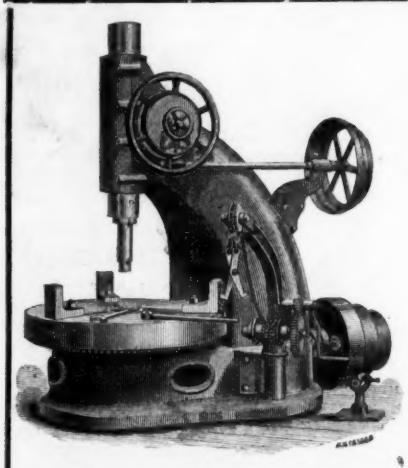


This Machine is arranged for doing a large variety of operations of grinding by the use of solid emery or corundum wheels. An additional movable table, capable of adjustment by a tangent screw and graduated arc, admits of straight and curved taper grinding with the centers of the machine always in line. It is specially adapted for grinding soft or hardened spindles, arbors, cutters, either straight or angular, reamers and standards, also for grinding out straight and taper holes, standard rings, hardened boxes, jewelers' rolls, &c. The work can be revolved upon dead centers or otherwise. The grinding wheel can be moved over the work at any angle, by which means any taper can be produced. Wheels from one quarter inch to 12 inches in diameter can be used either with or without water. The feed works and slides of the machine are covered and fully protected from grit and dust. The grinding of taper holes and angular cutters is provided for with graduated arcs. A special chuck for holding work to have holes ground, accompanies each machine. The spindle and boxes of the machine are of cast steel hardened and ground. Distance between centers, 28 inches; will swing 12 inches in diameter. The overhead works consist of a drum, tight and loose pulleys and adjustable hangers with self-oiling boxes. Countershaft should run 400 turns per minute. Tight and loose pulleys, 8 inches diameter, 4 inches face. Weight of machine, with overhead works, about 2300 lbs. Illustrated Catalogue sent per mail on application.



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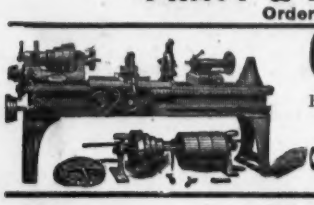

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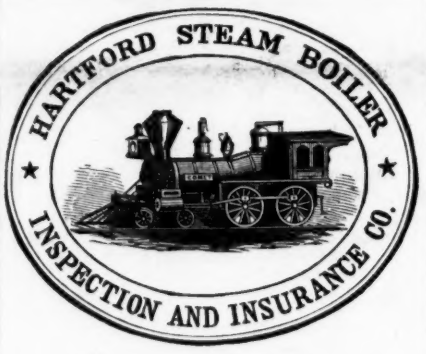

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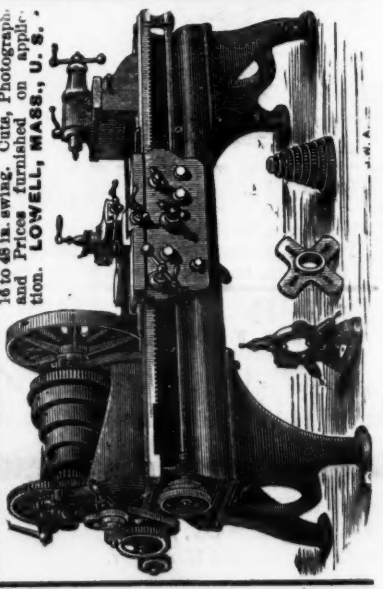

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